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PIG INDUSTRY.

THE PRINCIPAL BREEDS.

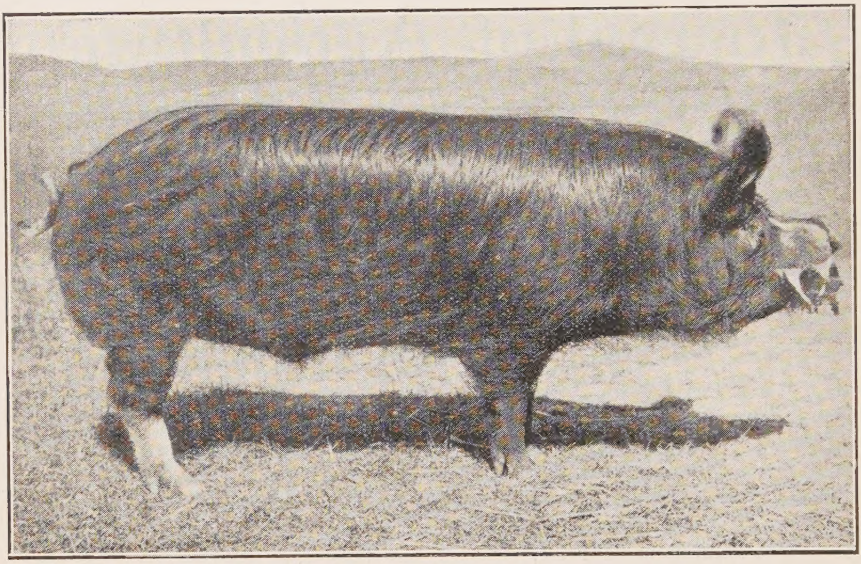
M. J. SCOTT, Superintendent of the Pig Industry.

ADVOCATES of the different breeds of pigs found in New Zealand may be disappointed because the virtues of their particular breed are not sufficiently stressed in these notes. It is now generally recognized that every breed possesses certain strains that can produce the kind of animal that is required, and the sooner it is admitted by everyone that pigs suitable for the English trade are to be found in every breed, and the sooner one breed, or at most two, are selected for the production of commercial pigs, the sooner will New Zealand pigs be keenly sought after on the English market. The improved demand for New Zealand pigs will arise from an improvement in quality associated with an improvement in uniformity, and uniformity is most important. When there are many equally good, but slightly different, articles offered to a buying population, business tends to be sluggish; each buyer is watching the others to be sure that no small point is missed, and all are hanging back till a certain fashion is established. Offer a buying public an article that is the same to-day, to-morrow, in all shops and markets, and it tends to buy freely of the best that is offering. Only the best is good enough, and the moral for the producer seems to be "have only one best and no worst."

THE BERKSHIRE.

The Berkshire is the best-known breed in New Zealand, and the majority of grade sows have a dash of this blood in them. They are looked upon as a hardy pig and a good doer. While this was a virtue in days gone by, and was shown by the way in which the pig piled on fat on the crest of his neck just between his ears and the top of his shoulder-blades, that same class of pig is not so desirable to-day except for the pork trade, or for the pig-jobber who does not care what kind of pigs he produces so long as they do well and get off the place. This type of Berkshire has been replaced in the stud world, almost entirely, by a longer, leaner animal that produces almost as good a carcass as the best of baconer breeds do. Berkshires make excellent porkers, but the fact that they are black discounts them somewhat on the English pork market. Baconers are not objected to because they are black as the operation of singeing removes the colour objection. The importation

Berkshire Types.



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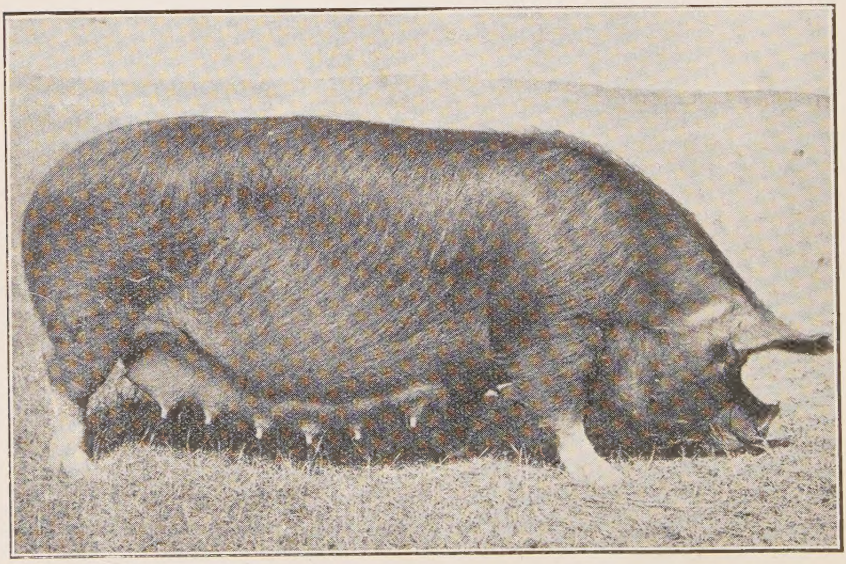


SOW (ROYAL CHAMPION, 1932).

[*N.Z. Farmer Weekly photos.*

some ten years ago from Canada of strains of Berkshires whose length, fine shoulders, and splendid hams made them highly suitable for the bacon trade did much to bring the Berkshire breed back into the public mind. If only the Canadian strains were more fixed for colour and "points-appearance," they would be entirely acceptable.

The Berkshire is one of the oldest of the improved breeds. It originated in County of Berkshire, England, but principal improvement in it was made in Leicestershire and Staffordshire. The original animal was large, similar to the Tamworth, coarse of body, and the colour varied. Marked improvement developed early in the eighteenth century, and was principally effected by Richard Astley and Lord Barrington. The first-known pedigree dates from 1859. Berkshires were first to be given a separate class at the Royal Agricultural Show, England, in 1862. The first herd book was issued in 1885. Early writers show that Chinese pigs were crossed with the Berkshire in their improvement. The improved Berkshire was greatly used on native swine in Ireland and Scotland, with beneficial results. This breed is most widely distributed and popular throughout the world, and does well in all climates.

Quality of Meat.

The Berkshire is noted for the high quality of its meat and the high proportion of the most profitable cuts which it yields. It is a producer of lean meat of the highest quality. The fact that the Challenge Cup for the best single pig of all breeds at the Smithfield Show has been awarded to Berkshires twenty times and to Berkshire crosses twice in forty years, and that the championship for the best pen of two pigs of all breeds was won by Berkshires twenty times and by Berkshire crosses eight times in forty-five years, affords further proof, if such were needed, that the breed is more than able to hold its own with others for early maturity. Weight for age is one of the prime requirements of judging at Smithfield; it is obvious that the breed would not have reached the top on so many occasions unless it had proved itself of inestimable value as a converter of food into meat in the least possible time.

Berkshires are hardy and may be relied upon to thrive under almost all conditions. In the Argentine, Australia, and New Zealand, countries in which the commercial aspects of live-stock breeding are alone of importance and where the most up-to-date methods are successfully employed, Berkshires constitute nearly two-thirds of the pure-bred population. This is a striking tribute to the suitability of the breed for all climates and conditions. In South Africa and Canada Berkshires are second in order of popularity; and they are found in increasing numbers in Central Europe, Japan, India, and the Malay States, as well as in Brazil and many other parts of the world. In the United States of America Berkshires have their own breed society, and it may be mentioned that at the International Live-stock Show, Chicago, held annually, Berkshires have sired over thirty champions and have won first prize in one or more classes twenty out of twenty-two years, a record unrivalled by any other breed.

Suitability for Crossing.

The value of the Berkshire breed for crossing purposes, especially when sows are crossed with a Large White boar, is widely recognized. Whether either the boar or sow is used to mate with other breeds, the progeny may be relied on to bear the stamp of the Berkshire's fine quality and to inherit its early maturing properties.

The standard of excellence for the breed, which was revised in 1928, is as follows:—

Character.—A combination of the following definitions, denoting type, quality, breeding, and masculinity in the case of boars and femininity in the case of sows and gilts.

Head.—Moderately short, face dished, snout broad. Wide between the eyes and ears. Ears fairly large, carried erect or slightly inclined forward and fringed with fine hair. Jowl light.

Neck.—Fine, evenly set on shoulders and free from wrinkles.

Shoulder-blades.—Fine and well sloping. Special notice to be taken regarding this point in the case of females.

Legs and Feet.—Short, straight, and strong, set wide apart, standing well on toes, and a good walker.

Back.—Long and level. Tail set high.

Sides.—Level and deep; ribs well sprung.

Hams.—Broad, wide and deep to hock.

Belly.—Thick, with straight underline, and deep through the heart.

Bone.—Well developed in males and fine in females.

Flesh.—Firm without excessive fat.

Skin.—Fine and free from wrinkles.

Hair.—Long, fine, and plentiful, with absence of mane, especially in females.

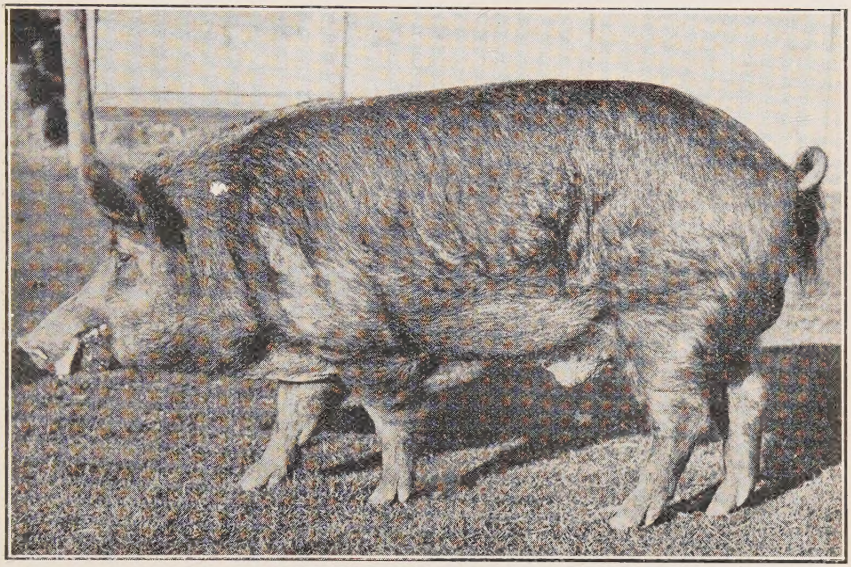
Colour.—Black, with white on face, feet, and tip of tail.

Imperfections.—Crooked jaw. Rose back.

The Tamworth.

Next in popularity to the Berkshire and gaining rapidly on it is the Tamworth breed. Being a bacon pig and one of the oldest of the established breeds it has blended with the Berkshire to make a better bacon pig, and the offspring have shown the distinctive Tamworth characteristics of hardiness and ability to look after themselves in a most pronounced way. The demand for leaner bacon during the past twenty years has been a great factor in bringing the Tamworth breed into prominence and displacing some of the more refined breeds. The natural stamina, prolificacy, and grazing-capacity of the Tamworths, combined with the great delicacy, firmness, and succulence of their flesh for bacon, commend them to the farmer in this country, where pasturage and open grazing are abundant. The breed has the reputation of being slow in maturing, but such has not been the case in New Zealand. Evidently the nature of the climate has produced a reaction towards quick maturity, and in experiments carried out the Tamworth has more than held its own with other breeds. Where the Tamworth has proved specially valuable is in crossing with other breeds and further imparting vigour, size, and prolificacy to half-breds as produced. Tamworth sows are good mothers and free sucklers. They are also noteworthy for the facility with which they farrow, and the small trouble they have in rearing large litters. Again, Tamworths have acquired a reputation for docility. They are easily managed, and do not show any disposition to be ill-tempered.

Tamworth Types.



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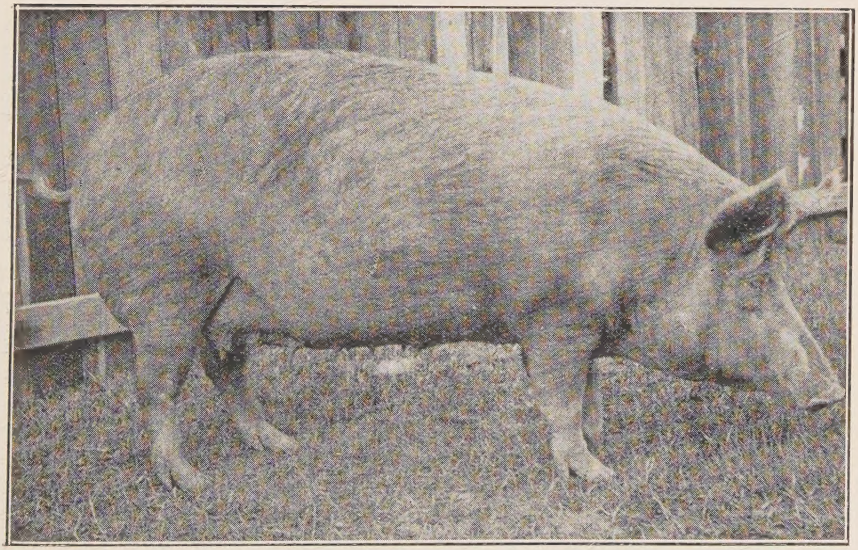


SOW (ROYAL CHAMPION, 1932).

[*N.Z. Farmer Weekly photos.*

Tamworths derive their name from the town of that name in Staffordshire, England, where they have been bred for a long period. They are probably the oldest and purest of all breeds in England, a circumstance that probably accounts for the wonderful marked prepotency of the Tamworth. At the beginning of the eighteenth century they were noted for large proportion of lean meat they produced. Have been greatly improved by selection, but it is generally conceded that no mixture of the breeds has been introduced in improvement. As early as 1847 they were given premier honours in competition with other large breeds at Royal Agricultural Show, England. Following this they went out of favour, but regained popularity from 1880 onwards.

Principal Points.

The principal points of the Tamworth are as follows :—

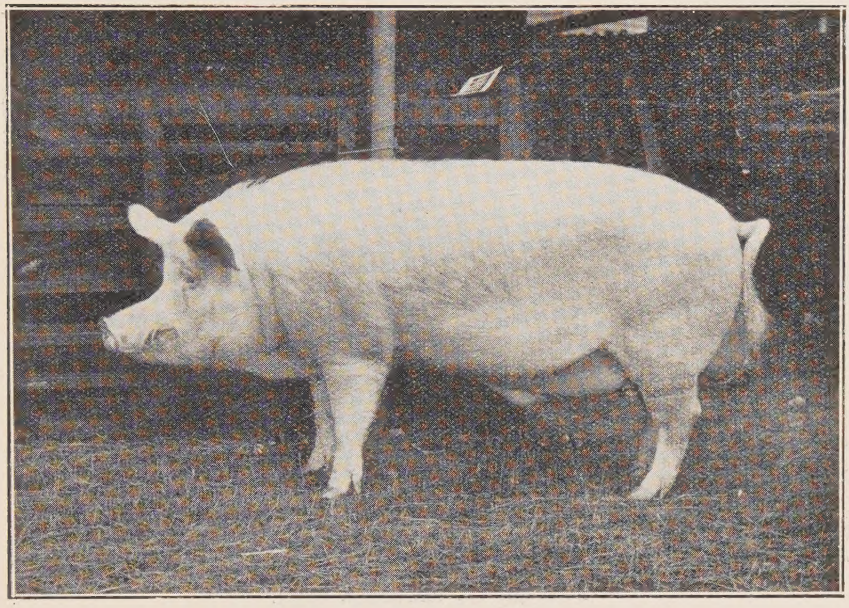
Head.—Long, lean, light, tapering to snout.
Ears.—Moderate size, fairly erect, pointing forward.
Jowl.—Light.
Neck.—Long, rather deep than wide, tapering.
Shoulders.—Sloping, good thickness through heart.
Back.—Moderately wide, long, slightly arched.
Barrel.—Long in coupling, deep ribs, well sprung.
Rump.—Deep, fairly full, rounded.
Ham.—Large, gradually rounded off rather than square.
Legs.—Moderately long, strong, firmly placed under body.
Skin.—Smooth, plentifully covered with hair.
Hair.—Freedom from coarseness.
Colour.—Bright golden red, no black.
Objections.—Shoulders coarse, open at top, ribs flat, weak coupling, shallow body.
Disqualifications.—Black or white hairs. Black skin.

THE LARGE WHITE.

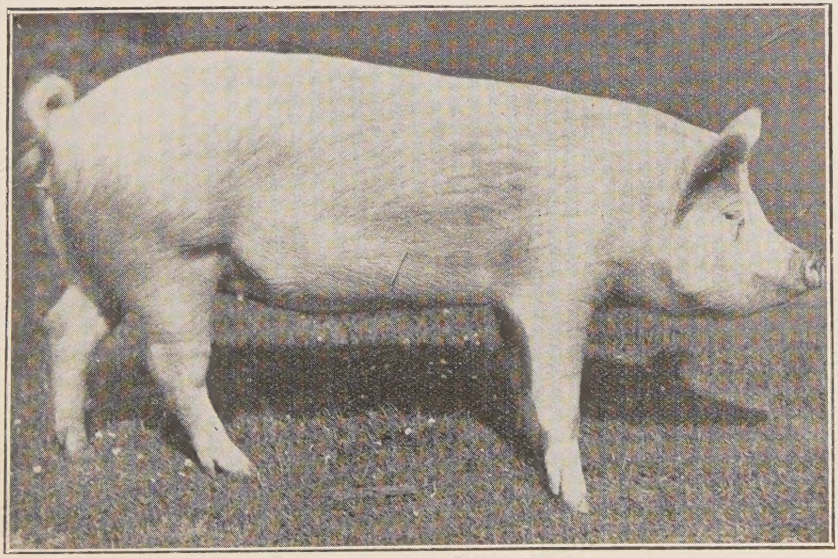
This is the world's bacon pig. In every country that is seriously producing bacon either one or else both the parents are Large White pigs. The White pig is the pig of the cold countries of the world, and, while this might infer considerable hardihood on the part of the White pig, it probably means a close association between these cold country people and their pigs. Possibly the White pig was well housed and cared for in these climates. Some say the Large White is a selection of the White Yorkshire pigs, the Small White being a selection from the same source. Other origins are attributed to these breeds, the Middle Yorkshire being reputedly a cross between Large and Small White Yorkshires. On the whole, New Zealand experience of White pigs has not been a happy one, although there are numerous exceptions to this generalization. Many have had White pigs that scald badly in hot weather or even in very rainy weather. When kept in the open, they are not always satisfactory, but it is an almost universal experience that the same pigs kept inside on warm beds grow more rapidly than any other breed or cross.

The Yorkshire originated in Yorkshire, England. It is bred from the old English hog, a large white animal. The Small Yorkshire owes its refinement to Chinese crosses, and the Middle Yorkshire to a cross

Large White Types.



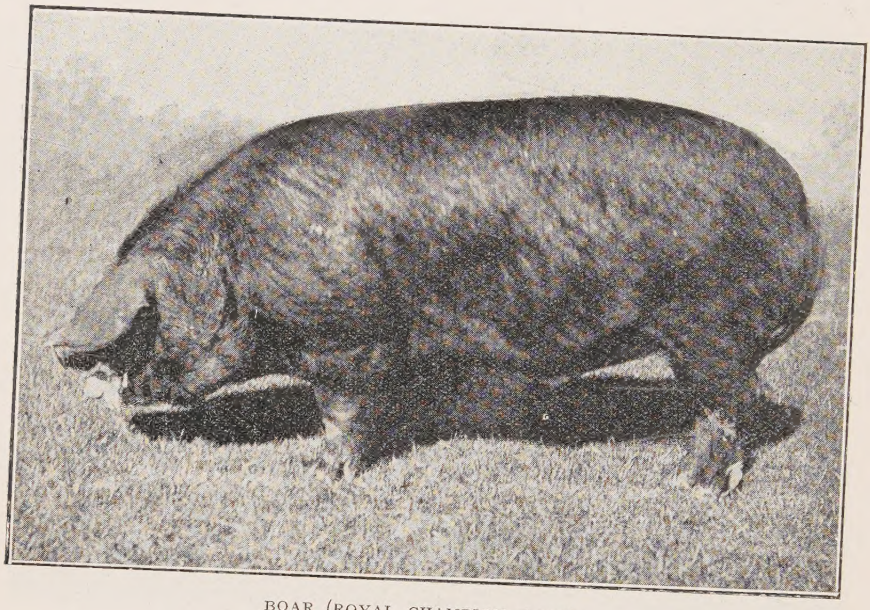
BOAR.



SOW (ROYAL CHAMPION, 1934).

[*N.Z. Farmer Weekly photos.*

Large Black Types.



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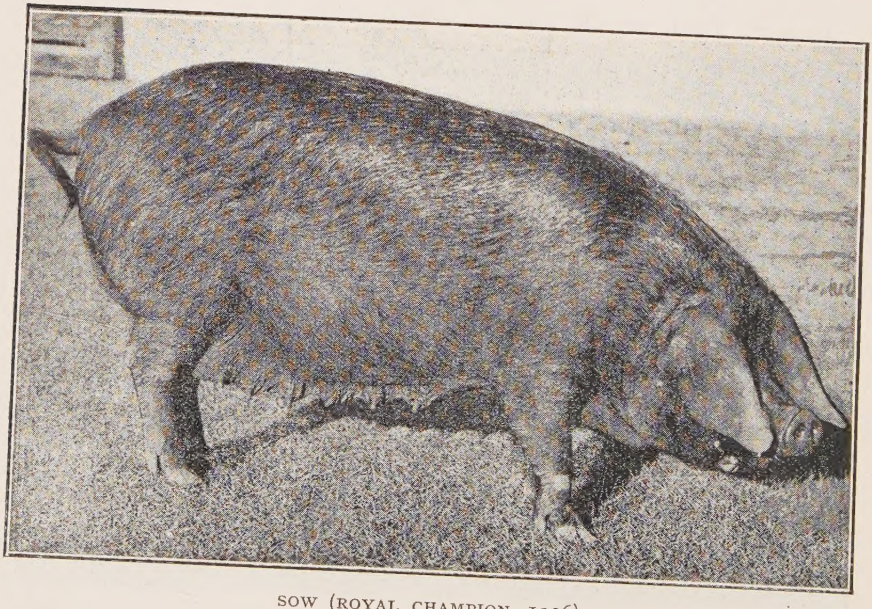

SOW (ROYAL CHAMPION, 1936).

[*N.Z. Farmer Weekly photos.*

between the two. The Middle Yorkshire was classed separately in 1852. Improvement commenced about one hundred and fifty years ago. Yorkshire blood is widely diffused throughout the world in all white breeds.

Principal Points.

The principal points of the Large White are as follows:—

Head.—Long, lightish, wide between eyes, face dished.
Ears.—Long, fine, inclined forward.
Jowl.—Light.
Neck.—Long, muscular.
Shoulders.—Sloping, no coarseness.
Back.—Long, wide, straight or slightly arched.
Barrel.—Deep, full-rounded, well-sprung ribs, flanks well let down, long, wide, square.
Hams.—Broad, full meat to hocks.
Legs.—Straight and strong.
Feet.—Firm.
Skin.—Cream colour, freedom from wrinkles or dark spots.
Hair.—Long, straight, fine.
Colour.—Pure white.
Objections.—Ears coarse, flopping; shoulders, coarse; weak back; unshapely hams; weak loins; crooked legs; weak feet; coarse, curly hair; action, sluggish.
Disqualifications.—Black or red hair or spots on skin.

Large Blacks.

Large Blacks are essentially bacon pigs. It is only with difficulty that they can be turned off as porkers. They are not sufficiently developed at the porker weight to produce a suitable carcass, being thin on the flank and usually loose over the loins. They are noted for their placid disposition and ability to forage.

Their origin is veiled in obscurity. There is no evidence of mixture of breeds. For generations the Large Black was the only pig known in Devon, Cornwall, Suffolk, and Essex. Its first herd book was started in 1899.

Outstanding Points.

The outstanding points of the Large Blacks are as follows:—

Head.—Medium length.
Ears.—Long, wide, falling over face, fine in texture.
Jowl.—Medium.
Neck.—Fairly long.
Back.—Long, broad, inclined to arch.
Sides.—Very deep.
Ribs.—Well sprung.
Barrel.—Ample capacity.
Hindquarters.—Long, wide, not drooping overmuch.
Hams.—Large and well filled.
Legs.—Comparatively short, straight, well placed.
Skin.—Fine, mellow to touch.
Hair.—Somewhat sparse, fine silky.
Objections.—Head, narrow, dished nose; Skin and hair, coarse or curly.
Disqualifications.—Ears, thick, coarse, or erect; colour, other than whole black.

Next month the breeding of pigs will be discussed.

ARTHRITIS IN LAMBS.

A paper read by W. C. BARRY, Director, Live-stock Division, Department of Agriculture, at the Sixth Annual Meeting of Sheep-farmers held at Massey Agricultural College, June, 1937.

THE disease known as arthritis in lambs has been observed in New Zealand for years past, and many sheepowners are familiar with the lameness produced in young lambs by this joint infection.

Arthritis means inflammation of a joint. The actual lesion varies from a simple excess of synovial fluid or "joint oil" to a condition of thickening of the tissues of the joint capsule. The articular cartilages of the joint are sometimes involved, when erosion takes place. In chronic cases there is seen permanent enlargement with accompanying stiff joint. In a minority of cases of arthritis pus is found in the joint, but in those cases the infecting agent is usually one of the pus-producing organisms—streptococci or staphylococci. This form is, however, comparatively uncommon. In a majority of cases no pus is found in the joint, but the synovial fluid is increased in quantity in the early stages. It is with this form of arthritis, which is due to a specific organism, and which is by far the most common type of the disease met with, that this paper deals.

The disease is sometimes referred to as "joint ill," or polyarthritis of lambs. Its distribution appears to be world-wide. In England the disease was studied in 1925 by Glover and Cornell at the Institute of Animal Pathology, Cambridge. It has been described in Germany. In Montana, United States of America, the disease has been intensively studied by Marsh; in Australia by Seddon, Carne, and others; and in New Zealand by Hopkirk and Gill at the Wallaceville Laboratory, who in 1930 published a most interesting *résumé* of their investigations into the disease in this country. They then recorded for the first time in New Zealand the association of a particular germ—very similar to, if not identical with, that which causes swine erysipelas in pigs, and known as *Erysipelothrix rhusiopathiae*—with arthritis of lambs. It must not, however, be assumed from this that the disease is in any way connected with the pig, as swine erysipelas is practically unknown in New Zealand. The finding of a similar organism in cases of lamb arthritis was later recorded from other countries.

ECONOMIC IMPORTANCE.

Arthritis of lambs is of considerable economic importance. It results in the partial condemnation of a large number of lamb carcasses at freezing-works during the killing season, the most commonly condemned portion being the leg, the stifle and hock joints being the most frequently involved. Along with enlargement of those joints, wasting of the muscles of the part occurs, spoiling the appearance of the leg. The knee is also frequently found affected. Meat-inspection records at freezing-works indicate that 0·138 per cent. of lambs are affected with arthritis. This means that for a season's killing approximately twelve thousand lambs are found affected with arthritis in some degree. Apart from the waste occasioned by condemnation of parts of affected carcasses, the disease is also responsible for economic loss to the sheepowner through

the setback which it brings about in affected lambs in a flock. Even when lambs are only very slightly affected and no symptoms are evident beyond a slight stiffness, which passes off in a few days, nevertheless such lambs receive a check in condition from which it takes them considerable time to recover.

The most susceptible age is up to three or four months, and the most common time when lameness among lambs is noticed is about a week to a fortnight after the lambs have been marked. The disease is occasionally seen in a flock before marking, but the majority of cases occur after that operation. The breed of sheep does not appear to have any relation to the disease ; it occurs in lambs of all breeds. It is held that a larger percentage of cases occur in wether lambs, and this is to be expected as the disease is generally supposed to be a wound infection, the inference being that the castration wound, in addition to the docking of the tail, offers an increased avenue of entry to the germ.

Symptoms of Disease.

The symptoms of the disease are fairly well defined, and no great difficulty is experienced in diagnosis. Its onset in a flock of lambs is usually sudden. The owner notices a number of lambs affected with lameness in one or more limbs, and examination will reveal tenderness of the joints—usually the stifle, hock, knee, and elbow. It must, however, be remembered that stiffness and lameness can be present without enlargement of the joints—the latter symptom is not seen at all in a large percentage of the cases. The lamb shows evidence of pain when attempting to place weight on the affected leg. There is consequently disinclination to move, and, as a result, rapid loss of condition through partial starvation. From the first acute symptoms a sub-acute form is developed, and a small percentage of lambs become chronically affected. Complete recovery, however, usually takes place in probably 80 per cent. of the cases within a month of the onset of symptoms. Mortality might occur in a small percentage of cases, and is probably the result of generalized infection. In the chronic cases deformity of the joints usually results.

The organism which causes the disease is generally believed to gain entrance to the circulation through a wound—either the freshly ruptured or unhealed navel, docking, castration, or ear-marking wounds. Having entered the circulation the germ appears to have a predilection for the joints, where the characteristic lesions are set up. The large number of cases which occur about a week following marking would strongly support the view that it is a wound-infection. In the cases which occur in younger lambs, and before marking, there is every reason to believe that the infection gained entrance through the navel.

Interesting Experiments.

In connection with the manner of infection, some interesting experiments were conducted by Hopkirk and Gill in 1928. An extract from their report is as follows : " Two ram lambs had the freshly-cut castration wounds sprayed with a culture of the organism, and three ewe lambs had the freshly-made docking wounds similarly treated. One ram lamb and three ewe lambs marked at the same time acted as controls. Lameness was noted in each of the three males and in two out of the six females

by the fifth day. The females showing lameness were two of the three whose docking wounds were sprayed. These nine lambs were operated upon in a small enclosure and the spray was made by an ordinary atomizer. As none of the lambs from the rest of the flock which were marked at the same time, but in another yard, showed any such symptoms it seems fair to regard them as controls and assume that the control male lamb which evinced arthritis was accidentally infected as a result of the spraying of the others. All marking wounds, sprayed and otherwise, healed quickly and normally without treatment. One ewe lamb showing obvious lameness at the expiration of three weeks was killed, and post-mortem showed acute arthritis of the limb joints. The specific organism was obtained in pure culture from one lamb, but the other two gave mixed growths. The other four affected lambs recovered from their lameness but did not thrive well, remaining culls till late in the season."

An experiment was also carried out by Hopkirk and Gill to illustrate infection through the navel. Each of a pair of twin lambs was inoculated, shortly after birth, into the tip of the navel string with a ½ c.c. emulsion of the arthritis organism. One lamb showed slight lameness affecting a hind limb two days later. Ten days later both lambs were markedly stiff in their movements, and, although getting plenty of milk, were not thriving. This continued, the lambs moving painfully about with the ewe, feeding well but remaining stunted. At three months old the lambs were killed, and post-mortem examination showed the characteristic joint lesions from which the specific organism was recovered.

Outbreak on Farm.

The following details of an outbreak encountered on a farm is of interest: "The lambs had been marked in a pen beside the horse stables, and as each lamb was dealt with it was dropped over the fence into the stableyard, where it lay for a few moments in the dusty and soiled litter before wandering on through the yard and back to the pasture. When seen some eight days after the marking of 200 lambs about 20 per cent. were affected in various degrees. The marking wounds had healed cleanly. No treatment was undertaken, and in three weeks all except about 5 per cent. were again sound. The following year the same farmer marked his lambs in a new yard and placed them straight from this into a clean grass paddock. The result was that not a single case of lameness occurred amongst them."

Hadleigh Marsh, of Montana, United States of America, who has conducted a lot of work on this disease, carried out some experiments in 1933, designed to show the portal of entry of the germ. He showed clearly that inoculation of cultures of the organism into the navel of young lambs produced the disease. Further, it was shown that newly-born lambs kept in pens on bedding which had been sprinkled with cultures of the organism developed the disease. This clearly demonstrated that in very young lambs the channel of infection is through the umbilicus. In the same way exposure of the docking and castration wounds to infected bedding resulted in the lambs so treated developing arthritis.

Having discussed the manner in which lambs become infected, we now come to the most important consideration—namely, prevention of the disease. Curative measures are useless, but prevention is possible

if certain precautions are observed at marking-time. On farms where the disease is known to occur docking should be carried out on a fresh site, the yards previously used for this purpose being avoided. All instruments should be sterilized by boiling before use, and frequently immersed in antiseptic solution during the operations. (A 2-per-cent. solution of Lysol, Jeyes' fluid, &c., can be employed.) In selecting the site for temporary yards for marking, a well-grassed area should be chosen. After marking the lambs on a rail of the outer fence, care should be taken to place them on their feet and allow them to run away on a clean grass paddock.

Use of Antiseptics.

Regarding the use of antiseptics: Too irritant solutions must not be employed. A 1-per-cent. solution (about 1½ oz. to the gallon of water) of any of the standard disinfectants (Lysol, Jeyes' fluid, &c.) will be sufficient. It is desirable to apply the solution to the skin of the purse and tail before castrating and docking are actually performed, as well as after. The use of a syringe by which the solution could be quickly "jetted" on to the parts by an assistant standing alongside the operator is worthy of consideration. Cleansing of the operator's hands and overalls must not be neglected.

Reference has been made to that form of arthritis which occurs before marking and in which the channel of infection is supposed to be through the navel. Preventive measures here will include antiseptic dressing of the navel string of newly-born lambs; for this purpose tincture of iodine is employed. This form of arthritis is, however, relatively uncommon. It is questionable whether the preventive measures are practicable in large flocks at lambing-time.

The use of the emasculator or bloodless castrating instrument (one make of which is known as the "Daroux") gives satisfactory results when properly employed might be considered on farms on which arthritis in lambs is common. By its use one avenue of infection, the castration wound, is eliminated. With regard to docking, it is held that the use of the red iron is generally followed by less trouble, and it is probable that rapid searing of the tail after severance with the knife would prove useful in the prevention of infection.

INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal*, include the following of agricultural interest:—

No. 77903: Seed-mixing attachment: A. R. Craddock. No. 77908: Milking-machine; R. J. Simpson. No. 77915: Wire-strainer; M. S. Chalmers. No. 77934: Flax-treatment: Oonah Ltd. No. 77957: Milk-cooler; E. Hoyland. No. 77959: Plow-coulter clamp; A. S. Shepherd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

The Fields Instructor, Masterton, records that a farmer in the Akitio district has successfully established subterranean clover by broadcasting on rolling country without any form of cultivation. Two autumns ago 3 lb. of subterranean clover seed per acre was sown broadcast on a 200-acre paddock.

PASTURE TOP-DRESSING IN THE AUCKLAND PROVINCE.

EXPERIMENTAL WORK BY THE FIELDS DIVISION, PERIOD 1928–36.

P. W. SMALLFIELD, Fields Superintendent, Department of Agriculture, Hamilton.

DURING the twelve months ended 31st January, 1936, over 1,500,000 acres of grassland were top-dressed in the North and South Auckland Land Districts as follows:—

	North Auckland. Acres.	South Auckland. Acres.	Total. Acres.
Fertilizers only ..	289,915	614,277	904,192
Lime only	20,018	24,751	44,769
Fertilizers and lime ..	162,433	421,082	583,515
	472,366	1,060,110	1,532,476

Phosphates, chiefly superphosphate, formed almost the entire bulk of the fertilizers applied, and only about one-third of the land received lime in addition to phosphates. In the last review(1) of Auckland top-dressing trials the conclusions reached were: "The results of the top-dressing trials . . . confirm general farm practice. Superphosphate is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime. Rock phosphates are generally inferior to superphosphate or slag. Potash responses are not frequent, and, when responses are secured, they are generally slight." During the past two years experimental work has greatly extended our knowledge regarding the use of potash and lime. Bell(2) has described areas where very definite and payable potash responses are obtained; and in other districts some slight potash responses have been recorded. Our knowledge regarding the use of lime has also increased, particularly through the work of the Soil Survey Division of the Department of Scientific and Industrial Research, enabling lime responses to be more definitely correlated with soil type.

THE USE OF LIME.

"Can nobody give us an answer—the truth and the whole truth of the operation of lime upon soils?"(3). So the question was framed eighty years ago, and now, although the whole truth still eludes us, the action of lime in improving soil fertility is better understood: it frequently plays a controlling part in soil fertility, preventing or correcting the conditions of "acidity" or "lack of basicity" (commonly called "sourness") that are unfavourable to many cultivated plants. Acidity in a soil commonly occurs in wet climates and is caused by the washing-

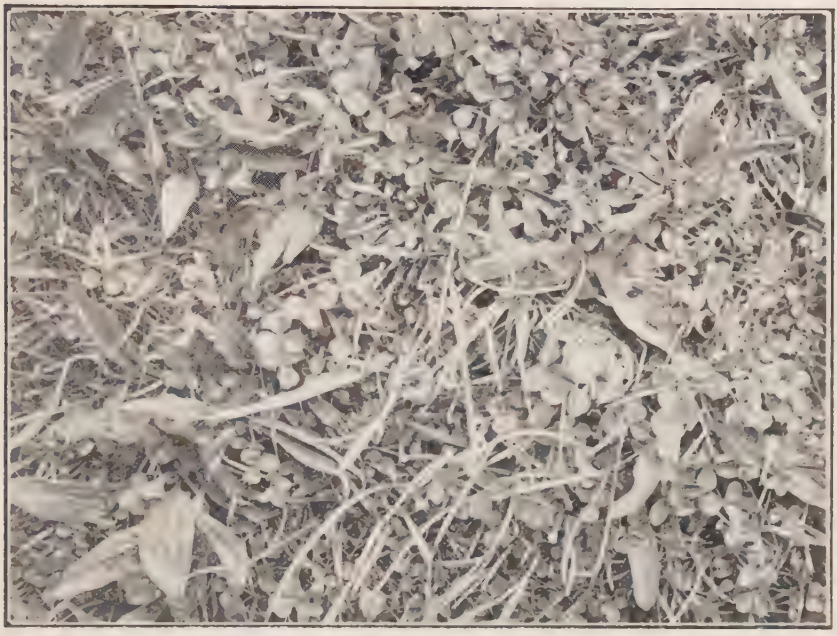

FIG. 1.

Experiment 16/1/432: Superphosphate plot on red-brown soil; two autumn dressings of 3 cwt. of super; response fair; sward consists of a little rye-grass, white and subterranean clovers, brown-top, and plantain making poor growth.

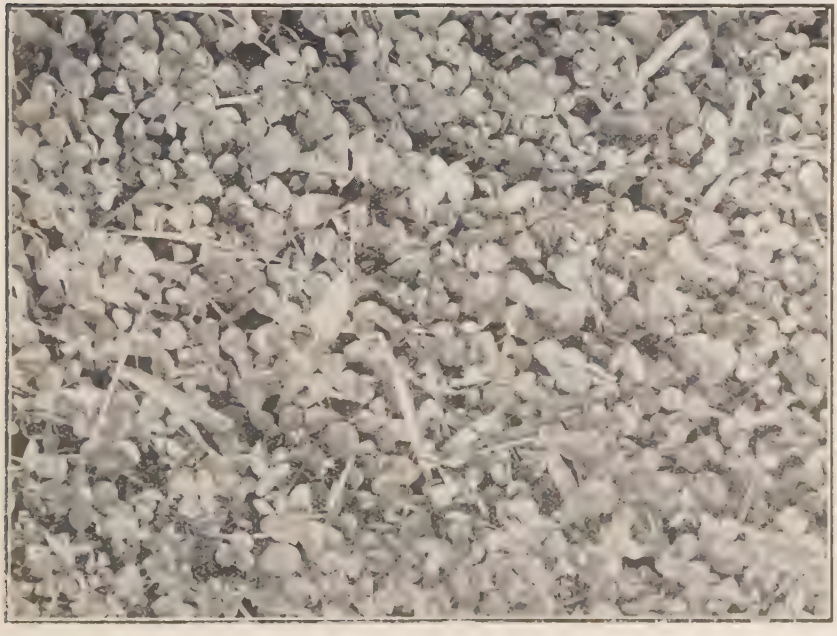

FIG. 2.

Experiment 16/1/432: Slag plot on red-brown soil; two autumn dressings of 3 cwt. basic slag; response good; dominant subterranean and white clovers with a little rye-grass and plantain making good growth. [*Photos, H. Drake.*

out of the bases from the original soil by percolating water. In acid soils soluble iron, aluminium, and manganese compounds are frequently present in sufficient quantities to injure plants, but so long as the soil reaction remains about neutrality the compounds of these metals present in the soil are practically insoluble and do not affect plant growth. This does not apply to red-brown-soil group, which may require lime although the soil is near neutrality. Although it is impossible to ascertain the amount of lime necessary for a soil except by actual field trials, the appearance of the soil profile—*i.e.*, the measure of soil leaching—is a fair guide as to whether a soil will or will not respond to lime. Young soils are not responsive to lime, leached soils are acid, frequently contain

FIG. 3.

Experiment 16/1/432: Slag plus lime plot on red-brown soil; two autumn dressings of 3 cwt. of slag, one ton of lime at laying down and one autumn dressing of 5 cwt.; response very good; good sward of clovers and grass making a strong growth.

[*Photo, H. Drake.*

toxic amounts of soluble iron and aluminium compounds, and respond to lime. This broad outlook on liming fits in quite well with the lime responses obtained in the Auckland Province. The young soils (volcanic ash showers) of the Bay of Plenty and Central Plateau do not respond to lime, the slightly podsolized soils of the Waikato give a slight response, and the mature podsols and red-brown soils of South and North Auckland show marked lime responses. The locality responses to lime and fertilizers are given in Tables I to V. In the Bay of Plenty super alone generally gave a good response, and in only three out of twenty-two trials did the addition of lime cause definite improvement. In the Central Plateau area super alone was consistently good, and only in one trial out of ten

did lime give an appreciable improvement; the effect of lime was often detrimental. Most of the trials in the Waikato were placed on land that had previously been top-dressed with phosphates for many years, and the relative response to phosphates and lime is not as marked as in other districts where top-dressing is a newer practice. As in the Waikato, the experiments in South Auckland were laid down on land previously top-dressed, and the response to superphosphate was relatively slight, particularly in the first year; on the clays and some of the red-brown soils lime and super has given better results than super alone. In North Auckland super and lime have given definitely better results than super alone.

FIG. 4.

Experiment 16/1/432: Super plus lime plot on red-brown soil; two autumn dressings of 3 cwt. of super, one ton of lime at laying down and one autumn dressing of 5 cwt.; response good; good sward of clovers and grass growing vigorously.

[*Photo, H. Drake.*

Potash and Phosphate Responses.

Except for the Waihi District(2) and some peat soils of the Waikato, potash responses are not very marked in Auckland. Trials laid down on sandy peat in North and South Auckland, although few in number, indicate that potash is a necessary fertilizer on this soil type. In the Waikato lime, super, and potash have given slightly better results than super and lime, and alternate mowing and grazing trials have now been established at Ruakura Farm of Instruction, Hamilton, to measure the lime, potash, and phosphate responses on the Hamilton clay loam, Horotiu sandy loam, and Te Kowhai loam soil types.

As has been quoted above, in the last summary of top-dressing experiments in Auckland the statement was made that "superphosphate

is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime." Further trials of super and slag have been carried out in North and South Auckland (red-brown soils and gumland podsols), and the results are given in Table VI. On these soils slag alone is better than super alone, lime and super is generally better than slag alone, super and lime and slag and lime are about equal, although there is an indication that slag and lime may be slightly better than super and lime.

Experimental Plots.

The top-dressing plots were laid down in duplicate on farmers' fields and were kept under observation for periods of from two to four years. They were treated as follows: at laying down—(1) carbonate of lime, 1 ton per acre; (2) super or slag, 3 cwt. per acre; (3) 30 per cent. potash salts, 2 cwt. per acre. Annual top-dressing consisted of—(1) carbonate of lime, 5 cwt.; (2) super or slag, 3 cwt.; (3) 30 per cent. potash salts, 2 cwt. per acre. The arrangement of the plots was such as to give comparisons of each treatment and combinations of the above treatments with no manure. The method adopted to indicate the nature of the differences has been to award points based on visible responses as compared with no manure as follows: 0, no visible response; ?, doubtful response; 1, slight response; 2, fair response; 3, good response; 4, very good response; 5, excellent response; half points are also used—*e.g.*, $1\frac{1}{2}$ = slight to fair.

Table I.—Responses to Fertilizers: Bay of Plenty.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/120	Sandy loam	?	2	0	3	2	2
121	,, ..	0	3	?	3	3	3
124	,, ..	0	3	0	3	3	3
139	,, ..	0	3	0	3	3	3
140	,, ..	0	3	0	3	3	3
141	,, ..	0	3	?	$3\frac{1}{2}$	$3\frac{1}{2}$	4
162	,, ..	1	3	0	4	3	4
176	,, ..	2	3	0	4	3	4
201	,, ..	1	2	0	2	2	2
240	,, ..	$\frac{1}{2}$	$2\frac{1}{2}$	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	3
254	,, ..	0	2	0	2	2	2
255	,, ..	0	$2\frac{1}{2}$	0	3	3	3
256	,, ..	1	$3\frac{1}{2}$	$\frac{1}{2}$	4	4	4
257	,, ..	$\frac{1}{2}$	3	$\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
258	,, ..	$\frac{1}{2}$	4	0	4	4	$4\frac{1}{2}$
261	,, ..	?	$1\frac{1}{2}$	?	2	$2\frac{1}{2}$	$3\frac{1}{2}$
274	,, ..	0	$2\frac{1}{2}$	?	$2\frac{1}{2}$	$2\frac{1}{2}$	3
275	,, ..	0	$1\frac{1}{2}$	0	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
283	,, ..	$\frac{1}{2}$	2	?	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
362	,, ..	0	$3\frac{1}{2}$	0	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
288	Gravelly sand ..	0	2	0	2	2	2
276	Peat	?	$\frac{1}{2}$	?	2	$1\frac{1}{2}$	2

Table II.—Responses to Fertilizers: Central Plateau.

Trial.	Soil Type.	Responses to Fertilizers. (o, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.)					
		Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/156	Sandy loam ..	1	4	1	3½	3½	3½
188	,, ..	1	2½	½	3	3	3½
189	,, ..	−1	3½	1½	3½	4	4
190	,, ..	?	3	1	3½	3	3½
191	,, ..	−2	3	0	3½	3	3
203	,, ..	−1	2	1	3	4	3½
206	,, ..	1	3	1	3	3½	3
207	,, ..	− ½	3	½	3	3	3
209	,, ..	1	3	½	3	3½	3½
210	,, ..	1	2½	?	2½	3	2½

Table III.—Responses to Fertilizers: Waikato.

Trial.	Soil Type.	Responses to Fertilizers. (o, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.)					
		Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/243	Hamilton clay loam	1	2	1	2	3	3½
251	,,	1	3	1	3½	3½	4
252	,,	½	1	½	1	1	1
422	,,	½	2½	½	2½	3	3
423	,,	1	2	1	2½	2½	3
239	Horotiu sandy loam	½	1½	1½	2	3	3
342	,,	½	1½	2	2	3	4
346	,,	½	2½	½	2½	3	3
374	,,	1	1½	½	2	2	2½
376	,,	½	1	1½	1½	2½	3
343	Whatawhata clay loam	½	2	½	2	2	2½
404	Ditto	1	2	½	2½	2½	
235	Te Kowhai loam ..	½	1	½	1½	1½	1½
236	,, ..	1	1½	½	2	2	2½
344	,, ..	½	1½	1	1½	2	2
375	Rotokauri clay loam	1½	2½	½	3	3½	3½
377	,,	1	1½	½	2	2½	2½
378	,,	1½	2½	1	3	3	3½
387	Ohaupo silt loam ..	1	2	2	2½	3	3
391	,,	1	2	½	2½	2½	3½
393	,,	1	1½	½	2	2	2
394	,,	1½	2	2	2½	2½	3
242	Peat	½	1½	1	2½	2½	3
352	,, ...	½	1½	2	2	3	3½
389	,, ...	½	1½	3½	1	4	4
390	,, ...	½	½	½	1	1	1
421	,, ...	1	1½	½	1½	2½	2½

Table IV.—Responses to Fertilizers: South Auckland.

Trial.	Soil Type.	Responses to Fertilizers. (o, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/263	Silt	o	3	o	3	3	2½
177	Red-brown soil	3	2	?	4	2	4
178	,,	?	1	o	1	1	1
198	,,	?	?	..	1	?	1
246	,,	o	½	2	½	3	3
279	,,	1½	2½	?	4	2½	4
282	,,	1	2½	o	3	2	2
285	,,	1½	1½	o	3	1½	2
311	,,	..	½	2	1	2	3
313	,,	..	1½	o	3	2	3
314	,,	..	½	o	½	1	1
167	Clay	1	1	o	2	1	2
169	,,	3	?	?	3	?	3
195	,,	3	1	..	4	1	4
250	,,	2	2	o	2½	1	4
318	,,	..	3½	o	4½	4½	4½
245	Loam	½	1	1½	1½	2½	2½
249	,,	?	3	—1	3	2	2
286	,,	½	2	o	2	2	2
289	,,	½	o	1½	1	2	3
247	Sand	o	1	1½	1	2	2½

Table V.—Responses to Fertilizers: North Auckland.

Trial.	Soil Type.	Responses to Fertilizers. (o, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/94	Silt	o	2	1	4	3	4
147	,,	1	1½	?	2	3	5
181	,,	1	2	1	3	2	4
297	,,	1	2½	o	5	2½	4
298	,,	1	2	o	3½	2	3½
317	,,	1	1	2	2	2½	3
373	,,	..	1½	o	2½	1	3½
384	,,	..	2	½	3½	2	4½
160	Red-brown soil	2	2	o	4	3	4
180	,,	1	2	?	3	3	4
184	,,	2	2	?	3	1	3
266	,,	..	2	o	2½	2	3½
267	,,	..	1½	½	2½	2	3½
269	,,	..	2	o	3	2	3
271	,,	½	1½	½	2	2	2½
316	,,	1	2½	1	4	2½	4½
383	,,	..	½	o	2½	2	2½
385	,,	..	2½	o	3	½	2½
427	,,	..	½	o	2	½	2½
428	,,	..	1½	o	2½	1½	3
431	,,	..	1½	o	2½	2	3
432	,,	..	2	o	3	2	4½

Table V—continued.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/492	Red-brown soil ..	..	1½	½	2½	1½	3
98	Clay	0	3	0	3	3	3
132	,, ...	1	2	1	3	3	3
183	,, ...	4	1	?	5	1	5
185	,, ...	2	1	1	3	3	3
260	,, ...	1½	3	0	5	2½	4½
265	,, ...	..	1½	0	2½	2	3
278	,, ...	..	2	0	3	1	3
280	,, ...	..	3½	3	4	3	4
290	,, ...	1	2	0	4	2½	4
293	,, ...	0	2	0	2½	2	2½
315	,, ...	1½	2	0	3	2	3
291	Loam	½	3	0	4	3	4
292	,, ...	?	2	0	2½	2	2½
294	,, ...	1	4	0	5	4½	5
295	,, ...	½	3	0	3½	2½	3
268	Sand	½	2½	0	3½	3	3½
281	,, ...	..	3	1	3½	3	4
270	Sandy peat ..	½	4	?	4	4	4½
284	,, ..	..	2	1	3	4	4½

Table VI.—Responses to Fertilizers: North and South Auckland.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Slag.	Super.	Lime plus Super.	Lime plus Slag.	Lime plus Super plus Potash.	Lime plus Slag plus Potash.	Potash.
16/1/373	Silt	2½	1½	2½	3½	3½	4½	0
384	,, ...	3½	2	3½	3½	4½	5	½
266	Red-brown soil ..	2½	2	2½	2½	3½	3½	0
267	,, ..	3	1½	2½	3	3½	4	½
269	,, ..	2	2	3	3	3	3½	0
311	,, ..	0	½	1	0	3	1½	2
313	,, ..	2	1½	3	3	3	3	?
314	,, ..	0	½	½	0	5	5	1
383	,, ..	2	½	2½	2½	2½	3½	0
385	,, ..	2½	2½	3	3	2½	4½	½
427	,, ..	2½	½	2	3	2½	3½	0
428	,, ..	2	1½	2½	3	3	3½	0
431	,, ..	2	1½	2½	2½	3	3	0
432	,, ..	3	2	3	4	4½	4½	0
492	,, ..	2½	1½	2½	3	3	3½	½
265	Clay	2½	1½	2½	3	3	3½	0
278	,, ...	2½	2	3	3	3	3	0
280	,, ...	4	3½	4	4½	4	4½	0
318	,, ...	4	4	4½	4	4½	4½	0
284	Sandy peat ..	2½	2	3	3	5	5	1

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SCIENTIFIC TESTING OF DAIRY-PRODUCE FOR EXPORT.*

A BRIEF HISTORICAL REVIEW.

G. M. MOIR, Dairy Laboratory, Wallaceville.

ABOUT half a century ago, when our dairy industry was in its infancy, the difficulties which beset the pioneers were immense by comparison with those of the present day. In order to overcome the obvious lack of knowledge which prevailed, the Government of the day recognized the necessity for a dairy instructional service as part of State assistance toward the development of agriculture. Every effort was made to obtain men of experience for this work, but owing to the lack of knowledge, both scientific and practical, the early officers were often thrown upon their own resources in trying to discover the most suitable procedures. To-day a large amount of experience is available to indicate, for example, the most suitable temperatures for various manufacturing operations and storage conditions. Much of this experience is based upon the methods of trial and error which the early instructors were forced to adopt, often without the facilities either for precise control provided by modern refrigeration or of systematic procedure as applied in present-day scientific investigation. By the careful and persistent efforts of the instructors, in co-operation with factory-managers and farmers, many of the early problems were solved one by one. Thus the instructional, grading, and testing system has been gradually built up to function as smoothly and efficiently as it does to-day.

Contrary to the prevailing impression that only within the last few years have efforts been made to apply science to dairying in New

* This article is the substance of a paper which was read at the Auckland meeting of the Australian and New Zealand Association for the Advancement of Science in January, 1937.

Zealand, it can truthfully be asserted that from the earliest times such scientific methods as were available were introduced. To support this statement many examples could be cited, but two outstanding ones are the Babcock test and the acidimeter. The Babcock test was introduced to New Zealand in 1892, only two years after it was devised in America by Dr. S. M. Babcock, while the acidimeter was introduced thirty-five years ago by Mr. W. M. Singleton, now Director of the Dairy Division. In his original bulletin he records that the test was devised in 1899 by the English cheddar-cheese expert, Professor F. J. Lloyd, and was first used abroad at the Kingston Dairy School, Ontario. In addition to sound practical experience before his arrival in New Zealand, Mr. Singleton, in his dairy-school training, had opportunities of becoming conversant with the most up-to-date scientific information then available. He was, in fact, one of a number of overseas experts such as Messrs. Ruddick, Kinsella, Petersen, Sorensen, and others who were brought to this country to assist in the early development of the dairy industry. Many examples, past and present, could be cited of men who have been anxious to have more scientific assistance. This thirst for knowledge, which from the beginning possessed the leaders of the dairy industry, shows that they recognized the value of applying science to practice. Their close contact with practical conditions enabled them also to realize the difficulties which stood, and to-day still stand, in the way of attaining this ideal.

Early Scientific Work.

Early reports of the Department of Agriculture show that the Dairy Division frequently had the assistance of the Department's scientific staff, particularly Dr. J. A. Gilruth for bacteriological work, and Mr. B. C. Aston for chemical work. For example, standard alkali was supplied free of charge to factories from the Department's chemical laboratory to encourage the introduction of the acidimeter. In later years a considerable amount of work was undertaken for the Division by this laboratory, whose chemists supervised much of the early testing-work in the grading stores. In this connection mention should be made especially of the services rendered by the late Mr. F. T. Leighton, who took a great interest in dairy-work. The time of these officers was, however, often taken up with other duties, so that the Dairy Division did not get nearly as much scientific assistance as it required. This is made clear by the following quotation from the annual report of the Dairy Commissioner, Mr. J. A. Kinsella, in 1901: "No proper departmental facilities exist for carrying out such investigations on scientific lines." It was not until 1928 that Mr. G. F. V. Morgan was appointed to the Dairy Division to undertake bacteriological testing of faulty produce. In spite of the fact that the Dairy Division is still to-day, as it was in Mr. Kinsella's time, lacking in scientific assistance, appreciable progress has been made, and many useful investigations have from time to time been carried out and recorded on the departmental files without further publication. Failures have been forgotten, and successful methods applied to daily practice.

Referring again to the acidimeter for the titration of whey during cheesemaking and of cream in buttermaking, its value to the industry can scarcely be assessed. Simple as the test appears, it is not without pitfalls. One of the commonest mistakes which was pointed out in Mr. Singleton's original publication is that of titrating to too deep a

shade of pink. Notwithstanding the constant efforts of the Dairy Instructors this fault still occurs, especially in butter-factories, as Mr. G. M. Valentine's bulletin points out, but a method of checking this is now available, and is described later.

For a time after the introduction of the fat test, the accuracy of all the glassware used for milk and cream testing in the factories was checked in the Department's chemical laboratory. For some years this has been checked in the grading stores. In the early development of the test-room work a great deal had to be done with very primitive facilities. To-day many improvements have been introduced and better equipment provided in the testing-rooms. In Auckland, where very large amounts of butter are dealt with, facilities are being provided for the introduction of various special tests which will be referred to later.

Cheese Investigations.

Some very useful information can be obtained about cheese by ascertaining its content of fat, moisture, and solids-not-fat. The first work of this kind was initiated about twenty-five years ago under the supervision of Mr. W. E. Gwillim. Several accounts of the early results were published by him in the *N.Z. Journal of Agriculture*, 1913, Vols. VI and VII, from the former of which the following quotation is taken :—

"The main objects of the examinations were to try to ascertain (1) to what extent the principal constituents of the cheese varied in the makes of the different factories, (2) whether the fat content was in conformity with the legal standard, (3) and whether knowledge of the chief component parts of the cheese would have any useful influence in assisting the grader to a better understanding of the merits or otherwise of the body and texture at the time of grading. . . . The content of moisture was ascertained by drying in a steam-jacketed oven, and the fat content by the Babcock method. Exception may be taken to these methods, but there are good grounds for believing that the results obtained are good and accurate enough for all practical purposes."

Systematic testing of cheese for moisture and fat content came into prominence during the period in 1929–31 when standardized cheese was made, and control was necessary to ensure that no cheese with less than 50 per cent. of fat in the total solids was exported. Although standardizing was stopped a certain amount of this work has been continued, chiefly for the purpose of checking factories which have unjustifiably high yields. At Wallaceville a simple grating machine for shredding the cheese has been found very convenient for obtaining a homogeneous sample. Such graters are now regularly used in all testing-rooms. By using also a suitable sampling tube to take portions of equal size from different plugs it is possible to prepare composite samples from several vats of cheese and thereby reduce the number of tests required. Cheese thus grated is in a very suitable form for drying, and also for fat tests by the Babcock method. Since the introduction of this system, samples of every vat of cheese at all the principal grading stores are taken and included in the Babcock test for fat. As the latter method has long been considered to give slightly lower figures, the use of a little normal butyl alcohol was suggested in order to improve the results. Tests carried out in the Auckland grading store

by Mr. A. G. Frieberg have shown that $\frac{1}{4}$ ml. of this alcohol per test gives improved accuracy when the results are compared with those obtained by the Werner-Schmidt method.

For salt tests upon cheese Dr. F. H. McDowall's method has been modified to enable it to be used in the grading stores, where it is occasionally applied. A few years ago many samples of cheese were examined at Wallaceville to see whether a pH test could be used to select cheese with too little or too much acid. Eventually the conclusion was reached that the grader's judgment of the colour was very reliable and much quicker. The same may be said of certain other chemical tests which may be useful to confirm the grader's judgment in special cases.

During the early stages of the establishment of the casein industry attention was given to various tests which might be suitable for assessing the quality of the casein. Eventually a borax solubility and pH colour test was devised by Mr. W. R. Mummery of the New Zealand Casein Co., who used it, in collaboration with Mr. J. W. Smith of the Division's Instructional staff, to indicate whether the casein had been properly treated in the factory. The regular use of this test in the grading stores enabled the stage to be reached when only a very small proportion of the samples failed to attain the standards specified in the method.

Moisture in Butter.

In the testing of butter consideration was early given to its moisture content. Thirty years ago a great deal of the butter exported had a water content several per cent. below that permitted (16 per cent.). When factories attempted to increase the water content, churnings were sometimes made with too much water. Systematic testing was required to check this, and eventually it was found necessary to test every churning. To-day an immense amount of work is involved in testing 186,000 samples annually, but this ensures that no butter is exported with excess moisture. Not very long ago serious complaints were made in London about the large quantities of overmoist butter arriving from a certain country, where the testing is not as thorough as in New Zealand. Systematic testing has for many years safeguarded our reputation in this respect. Overmoist butter is returned to the factory to be reworked, and is again tested before it can be exported.

Many years ago the salt content of butter was determined by dissolving the fat in acetone and titrating with silver nitrate. This was superseded by the method devised by Sammis, which, it may be mentioned, was recommended by Mr. W. E. Gwillim in 1913, and is still regularly used. It consists of the titration of an aliquot with silver nitrate and chromate, so that the burette reading gives the salt percentage. The method is rapid and reasonably accurate for practical purposes, and if necessary can be made more accurate by a simple modification. We have recently endeavoured to perfect an electrical method which is even quicker than the titration method. With adequate temperature control this gives very good results, but some difficulty has been experienced in maintaining the electrodes free from interference with fat and casein particles.

At one time certain overseas markets allowed boric acid preservative in butter while others did not. The latter required a certificate of

freedom from boric acid, and for this purpose the test with turmeric paper was applied to the serum of the butter in question. Testing is no longer necessary, as the use of boric acid has been discontinued since it was prohibited by British regulations in 1928.

In addition to the tests needed to satisfy the requirements of those to whom we export our butter, administrative considerations have necessitated the analysis of regular samples for fat and curd content. In this way a check can be kept upon certain creameries which have been found to export in their butter more butterfat than they purchase from their suppliers. For these tests the Kohman method is used, whereby, after heating to dry off the moisture, the melted fat is dissolved in petrol and decanted after allowing the curd to settle. The idea of using one of the new non-inflammable solvents for this purpose proved impracticable, owing to its high specific gravity, which prevented a satisfactory separation of the curd particles. The risk of fire can be reduced by using a high-boiling petroleum spirit which does not contain the more volatile fractions present in ordinary petrol.

Deterioration of Butter.

In New Zealand dairy practice it has long been realized that acid butters were liable to deteriorate seriously when stored. Reduction of the acidity of the cream with bicarbonate of soda avoided this. The use of excess of soda gave butter of quite remarkable keeping quality but at the sacrifice of flavour, which, if not actually recognized as alkaline, was often complained of as flat and neutral. Thus arose the desirability of a simple and rapid test to indicate the alkalinity of butter. The first work of this kind was done in 1932 in the Division's test-room at Castlecliff, Wanganui. There Mr. F. Bishop applied to butter the brom-thymol-blue indicator method used for casein-testing. Officers of the Dairy Division later drew Dr. McDowall's attention to this procedure, and he made a series of experiments using both brom-thymol-blue and phenol-red. In such tests the principal difficulty is that the butter serum, to which the indicator is added, is a milky liquid, while the standards are clear. At Wallaceville a means was eventually devised of preparing standards which are of a somewhat milky nature similar to the butter serum with indicator. These have now been in use for some time at several of the grading stores. The colour tests are very valuable for sorting purposes to enable the selection of butters which are too acid or too alkaline, and these are now frequently retested in Auckland by the more accurate electrical method. When due allowance is made for the difficulties, the agreement obtained is quite satisfactory. These tests provide the graders with a means of confirming their opinions about butters which are too acid due to the excessive use of starter, or too alkaline due to the excessive use of neutralizer. Thus careless use of the acidimeter in butter-factories can be checked.

For many years it has been realized that contamination of butter with iron or copper was a cause of serious defects. On occasions an experienced grader has been able to say that a certain butter owed its defective flavour to copper contamination, this being confirmed by a visit to the factory. Notwithstanding the skill of the graders, such a method has its limitations. Except for the work of Mr. W. Williams of the New Zealand Co-operative Dairy Company's Laboratory, very little has been done by way of systematic testing of our butter for metals. In the past this has been due partly to lack of staff and partly to the

difficulties of the methods available. The wet or dry ashing of butter is not an easy process, especially when the metals sought are present to the extent of only one or two parts per million, or even less in the case of copper.

Consideration has for some time been given to the possibility of developing a filtration method which would eliminate the necessity for ashing. Until the assistance of Mr. E. D. Andrews was available, insufficient time could be devoted to overcoming the many difficulties. After much careful work a suitable method has been evolved, whereby very satisfactory results can be obtained in estimating the iron content of 10-gram samples of butter, the operations being completely carried out in small centrifuge tubes and test-tubes. This method is now in use in the grading store in Auckland. By using larger centrifuge tubes we have the advantage of dealing with 25-gram samples. A similar method has also been evolved for the estimation of the copper content, for which 25-gram samples are essential. As a rule these filtration methods give better agreement of duplicates than the ashing procedure. The results so far obtained show that very few creamery butters approach the danger point in iron content. This is a tribute to the activities of factory-managers and Instructors in checking the use of rusty cream-cans. Regarding copper content, the position is not quite so satisfactory, but regular testing should enable the Instructors to track down badly tinned equipment.

Flavour Problem.

In one or two cases complaints of metallic flavour in butter have been investigated and evidence obtained that the trouble was of bacterial origin, due probably to the presence of lipolytic or fat-splitting bacteria. Thus we come to the question of the bacterial content of export butter. Although it has not so far proved possible to arrange for bacterial examinations to be done in the grading stores, samples are now regularly taken in sterile fashion in both Auckland and Wellington and forwarded to the laboratory at Wallaceville. Space does not permit of a detailed account of this work. With the assistance of Mr. R. R. Russell, simplified methods have been devised to ascertain the total count, the yeast and mould count, the count of fat-splitting germs, and the coliform content. Using these improved methods we have examined over a thousand samples of butter during the past year. The results obtained are now being regularly forwarded to the Division's Instructors to enable them to draw the attention of factory-managers to cases where the bacterial condition of their butter (and therefore of their equipment) is not what it ought to be, even though the butter may be grading well. Among other things these tests show that very few butters indeed actually contain moulds. Even surface samples rarely show mould infection. This trouble is apparently due to mouldy box timber from which the infection spreads under bad storage conditions.

This review indicates briefly the progress that has been made in the past and makes clear that there is still a great deal to be done. So long as we export dairy-produce faults will arise, and there must be increasing use of scientific tests to track these down so that our reputation for high quality can be maintained. It is unlikely that any of these tests can be used to grade the produce, but they are best applied to discover the reasons for faults which the graders detect, or which may develop after storage. Especially in regard to butter, the new testing methods described are in advance of those hitherto used either in New Zealand or in any other country.

THE TOMATO MITE (*Phyllocoptes* sp.).

W. COTTIER and G. G. TAYLOR, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research.

DURING October, 1936, tomato-growers in the Auckland District reported the occurrence of a disease on glasshouse tomato-plants, the cause of which was unknown. Examination of diseased plants revealed the presence of numerous small mites, specimens of which were sent to the Imperial Bureau of Entomology, London, and were identified by Dr. A. M. Massee as *Phyllocoptes lycopersici* Tryon.

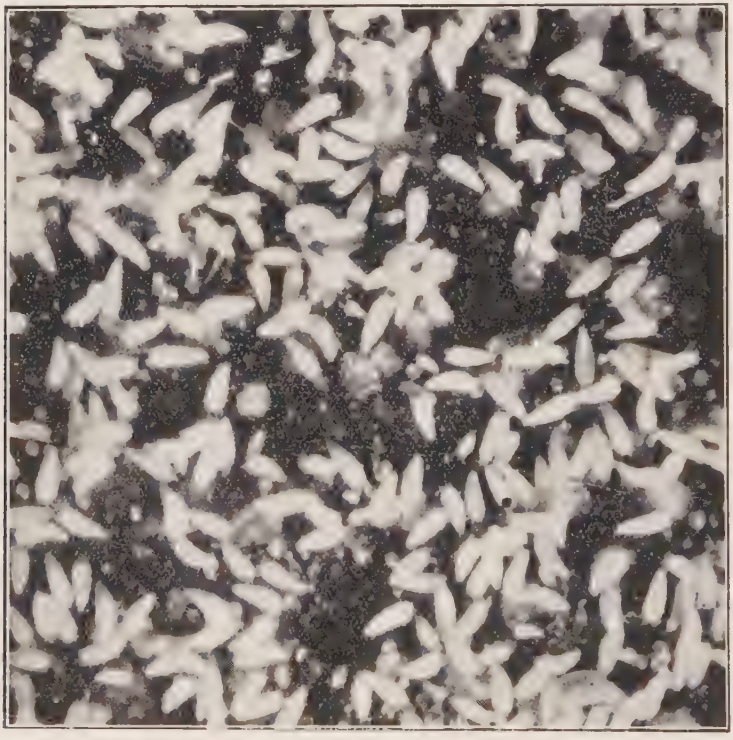

FIG. 1. MITES ON THE SURFACE OF A TOMATO-FRUIT.
Note the spherical shining eggs scattered through the colony. × 66.

Dr. Massee pointed out that the mite was first recorded by Tryon (1917) as a pest of tomatoes in Queensland, Australia, and that although it was named no specific description was supplied. Therefore the name used is invalid and the mite is here referred to as *Phyllocoptes* sp.

APPEARANCE OF THE MITE AND SYMPTOMS OF ATTACK.

The mites are small and can be seen clearly only under magnification (Fig. 1). They are elongated in shape and move by means of four legs placed at the head end of the body. The colour is cream in the adult form, and somewhat lighter in shade in the nymph stages. The mites

aggregate on the surface of the plants in large numbers, and to the naked eye have the appearance of fawn-coloured dust. The eggs are about one-quarter the size of the adults. They are round, smooth, white, and shining, and are deposited abundantly on the surface of the infested areas.

Infestation may occur at any stage of growth, but the presence of the mites usually is not apparent until the plants are well established. The powdery masses of mites are first apparent on the lower part of the main stems and on the adjacent leaf-stalks. Later the colonies migrate in an upward direction on to the leaves, stems of fruit bunches, and finally on to the fruit. As the mites spread and grow in numbers the stem develops a smooth, bronze-coloured appearance, due to injury to the epidermis and to destruction of the epidermal hairs.

The plants become stunted and pallid, whilst the more severely attacked leaves wither and die. Plants which are young at the time of infection usually become severely damaged and eventually die; on older plants spread of the mites may not be so extensive, but loss of crop usually occurs from reduced yield and damage to the fruit. Where the fruit is attacked a rough brown russet develops in the skin, accompanied by small cracks parallel to the circumference of the fruit, resulting in a characteristic "ringed" appearance.

Incidence of the Disease and Economic Importance.

Morgan (1935) states that the first authentic record of the mite in New South Wales, Australia, was in 1929, although he considers it probable that the mite was there for several years prior to this. In that State the mite has been found on both glasshouse and outdoor tomato-plants.

In New Zealand during the summer of 1936–37 a survey was made of the glasshouse tomato crops grown in the vicinity of Auckland. Most of the crops were found to be clean, but isolated cases of attack occurred in the Avondale, Blockhouse Bay, Otahuhu, and Birkdale districts. The degree of infestation varied on different properties; in some instances only a few plants were attacked, while in the most severe case four houses were involved, in one of which over 50 per cent. of the plants were heavily infested. Several growers reported previous experience of the disease. From the evidence obtained it would appear that the pest first occurred in severe form in the autumn crops of 1935, although the cause of the disease at that time was not recognized. The pest has not been reported from any of the tomato-growing centres other than Auckland, where it has appeared only on glasshouse crops of tomatoes.

Life-history, Over-wintering, and Spread.

The life-history of the pest has not been fully investigated. That the mites pass through their life-cycle rapidly is indicated by the observed fact that a small initial infestation may become acute within a few weeks.

Carry-over from one crop to another occurs most readily in those houses where two crops are grown in rapid succession each year. In certain cases, however, houses have been replanted within three weeks of the removal of an infested crop without any subsequent attack by

the pest. That the mites can over-winter in an unheated house seems probable, since live mites were found in the spring on old plants of an abandoned crop which had been heavily infested in the previous autumn.

Spread to glasshouses in which the mite has not previously been present may occur on the hands, clothing, &c., of visitors from infested houses or by the introduction of seedlings from infested nurseries. Once established the mites spread rapidly to healthy plants, and since they are relatively inert it would appear that the principal agents of distribution are the hands and clothing of workmen when pruning, cultivating, &c.

FIG. 2. SHOWING APPARATUS USED IN NICOTINE SULPHATE FUMIGATION.

The supporting stand consists of No. 8 fencing-wire bent into shape and stapled on a wooden base. [*Photo by H. Drake.*

Recommendations for Control.

Fumigation and spraying tests were conducted for determining suitable methods of control. Of the methods investigated fumigation with nicotine sulphate gave the most efficient results. Several houses have been treated under practical conditions and complete control obtained in each case.

Nicotine sulphate should be used at a dosage of 25 c.c. (28·5 c.c. approximately equal 1 fluid ounce) to each 1,000 cubic feet of house.

The cubic capacity in feet of the usual type of house with centre ridge may be calculated by multiplying the length by breadth by average height: Average height equals

$$\frac{\text{(height from ground to ridge plus height of outer wall)}}{2}$$

Suitable apparatus for volatilizing the nicotine consists of small metal containers and methylated-spirit lamps (Fig. 2). To ensure that a lethal dosage of nicotine vapour is obtained throughout the house it is advisable to have one lamp and container to each 2,000 cubic feet and to adjust the flame of the lamp so that the nicotine is volatilized in about one hour. Since few houses are gastight it is advisable to choose a calm day for the fumigation and to commence treatment towards sundown, allowing the vapour to act overnight. In the morning the house should be thoroughly ventilated.

Where the house is insufficiently gastight to allow of successful fumigation, spraying with nicotine sulphate may be adopted. For this purpose nicotine sulphate 1 pint to 100 gallons water with 2 lb. to 3 lb. soft soap should be used. Since it is almost impossible to obtain complete coverage, it is advisable to watch the plants closely for any subsequent spread of the mite and, if necessary, repeat the application.

Owing to the rapidity with which a small initial infection may become epidemic it is advisable to apply remedial treatment immediately the pest is observed.

In those cases where two tomato crops are grown each year the interval between the removal of an infested crop and the subsequent planting should be as long as possible. Care should be taken to remove all the old plants and, whilst the house is empty, to cultivate the soil thoroughly. As a precautionary measure fumigation or spraying is advisable as soon as the new crop is established.

Acknowledgments.

The authors express their thanks to Mr. W. H. Rice, of Messrs. Radley and Co., Auckland, who first drew attention to the presence of the mite; to Mr. C. P. Gibson, of the Horticultural Division, for his assistance in carrying out the survey; and to Mrs. G. B. Pettie, of Avondale, who made available a number of plants for experimental spraying and fumigation.

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An outstanding result from superphosphate top-dressed at 2 cwt. per acre in November on tussock hill-country near Fairlie is recorded by the Instructor in Agriculture, Timaru. An area of ½ acre, taking in both sunny and shady faces, was top-dressed and there has resulted a remarkable clover-growth, the clovers being red, white, and alsike. These clovers, save for a little stunted white, seem non-existent in the rest of the sward, which consists mainly of tussock, danthonia, catsear, brown-top, and haresfoot trefoil. No clover was sown with the superphosphate.

APPLICATION OF ORCHARD SPRAYS.

IV. SPRAY COVERAGE.

G. G. TAYLOR, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research.

THE significance of spray coverage as an essential factor in successful disease and pest control became apparent in New Zealand following surveys made in Nelson during the 1932–33 season and in Hawke's Bay in 1933–34. From the records obtained it was shown that wide differences occurred from one orchard to another in the volumes of spray applied per tree, and in the nozzle pressure maintained. Thus in different orchards where trees were of similar size the volume of spray applied per tree varied from ¾ gallon to 4 gallons and nozzle pressure from 100 lb. to 500 lb. per square inch. It was apparent, therefore, that either wide differences in disease-control were being obtained or in certain instances excessive amounts of spray were being applied. Similarly, differences in pressure indicated that these were unnecessarily high in some instances, or that, in others, the low pressure maintained resulted in inefficient disease-control.

The present series of experiments were undertaken to determine the significance of spray coverage in disease-control, and to ascertain the most efficient method of obtaining maximum coverage.

VOLUME APPLICATION.

To obtain maximum coverage it is necessary to apply more spray than is retained by the tree. Theoretically, wastage of spray could be reduced to a minimum by maintaining a low rate of delivery at the nozzles and by spending sufficient time in spraying. To be economical, however, spraying must be completed within a reasonable minimum time. With reduction in time of spraying a more than proportionate increase in volume delivery is required to assure that maximum coverage is obtained, with the result that a greater volume of spray is applied. The quantity retained by the tree, however, remains the same. Thus the volume application necessary to give maximum coverage is a variable factor dependent on the volume delivery of spray at the nozzles and on the time spent in spraying.

Experiments were carried out to determine (i) the significance of volume delivery and time of spraying on spray coverage, and (ii) the effects of variations in volume delivery on control of codling-moth, black-spot, and red-mite.

INCREASE IN TIME OF SPRAYING AND IN VOLUME APPLICATION.

EXPERIMENTAL METHOD.

The trees were selected by measurement, the average height being 8 ft. 3 in., and the average span of limbs 8 ft. 6 in. Volume delivery was kept constant at 1·375 gallons—*i.e.*, 222 fluid oz.—per minute, the treatment of the different plots being varied by increasing the time spent in spraying from 20 seconds per tree to 150 seconds per tree. Thus the minimum volume application was 73 fluid oz., and the maximum

550 fluid oz. A spray of 7·5 lb. hydrated lime* in 100 gallons of water was applied with a power spray-pump at a nozzle pressure of approximately 250 lb. per square inch.

Differences in coverage were ascertained by observation and by chemical estimation† of the weight of calcium hydroxide residue on samples of leaf tissue. Samples were obtained by cutting disks of tissue from the centres of leaves by means of a $1\frac{1}{4}$ in. hollow punch. Sixty disks were taken from each tree, thirty being from the outer parts of the tree, ten from the highest parts, and twenty from the inner portions. Leaves were picked in groups of eleven, and from these the disks were punched, the lowest being discarded to avoid possible loss of spray material or contamination from the board on which they had rested.

Preliminary tests indicated that samples of sixty leaf disks per tree gave sufficiently consistent results to show significant differences beween the various treatments.

RESULTS.

Where the lowest volume of spray (73 fluid oz.) was applied, in the shortest time (20 seconds) fine droplets of spray were deposited on portion of the fruit and foliage. Some of the leaves carried a continuous film of spray, and on certain of the apples the fine droplets of spray had coalesced to form larger drops. Considerable areas of the fruit and foliage were untouched by spray. As the time of spraying and therefore the volume application were increased, the areas completely covered with spary became more extensive, the parts with a cover of fine droplets less frequent, and fewer areas remained free of spray. Where 2 gallons (320 fluid oz.) were applied the trees appeared to be saturated with spray.

Chemical analysis showed that with increase in time of spraying and in volume application the quantity of spray residue on the samples of leaf tissue increased. The rate of increase in the quantity of spray residue recovered was rapid at first, became reduced as the higher volume applications were reached and finally, after the trees were saturated with spray, constant amounts of spray residue were recovered irrespective of the quantity of spray applied (Fig. 1).

Increase in Volume Application with Constant Time of Spraying.

EXPERIMENTAL METHOD.

Trees of approximately equal size were sprayed in five plots of four trees. The time of spraying was the same for each plot, but the volume delivery was varied by altering the diameter of the disk aperture in the nozzles so that volume application was increased. Each tree was sprayed for one minute, the minimum volume application per tree being 142 fluid oz., and the maximum 480 fluid oz.—*i.e.*, 3 gallons.

In addition to the estimation of spray residue on samples of leaves, the residue on fruit was measured. For the latter purpose sixty apples were taken at random from each plot, repeated tests having shown that this number gave sufficiently consistent results.

* A high quality commercial product in which 88 per cent. of the particles were 10 microns and less.

† The majority of the analytical work recorded was carried out by the Dominion Laboratory, Department of Scientific and Industrial Research, Wellington.

In the experiment in which the spray residue on applies was measured hydrated lime was used at 6·3 lb. per 100 gallons of water. The average height of the trees was 8 ft. 6 in. and the average span of

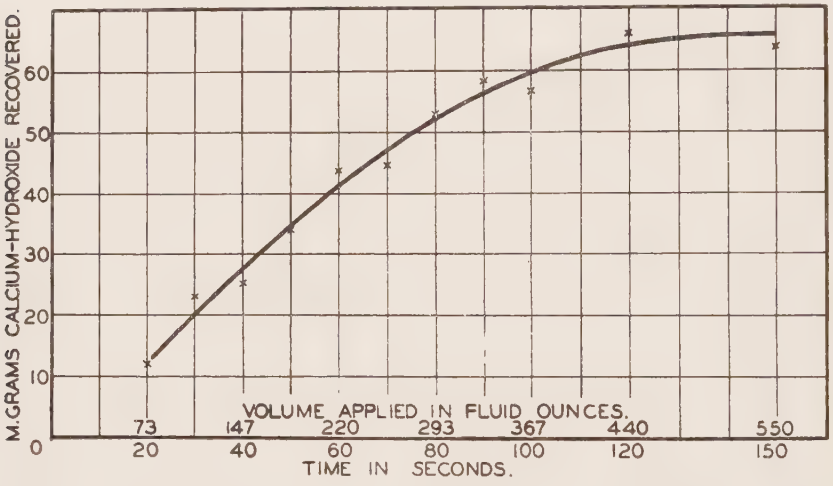

FIG. 1. EFFECT OF INCREASE IN TIME OF SPRAYING AND IN VOLUME APPLIED ON THE AMOUNT OF SPRAY RESIDUE ON LEAF-SAMPLES.

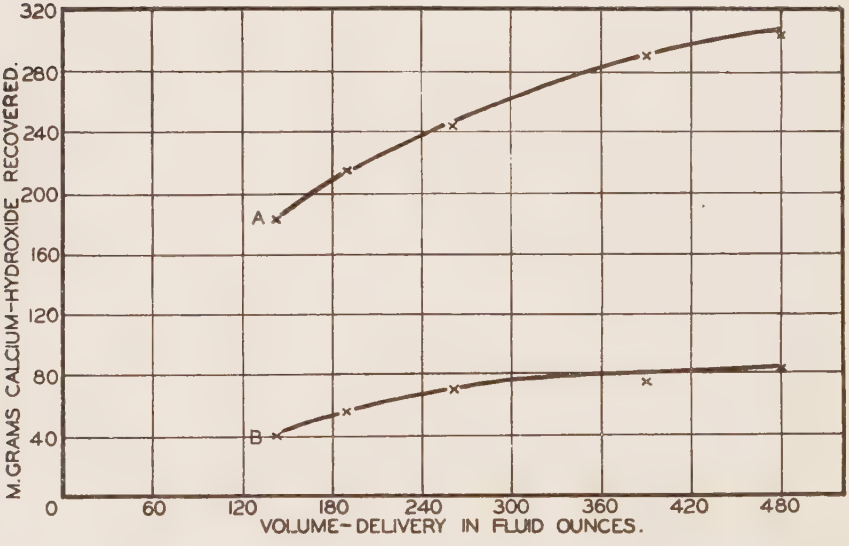

FIG. 2. EFFECT OF INCREASE IN VOLUME DELIVERY ON THE AMOUNT OF SPRAY RESIDUE ON (A) FRUIT-SAMPLES AND (B) LEAF-SAMPLES.

limbs 8 ft. 8 in. Where leaf-samples were taken lime was used at 7·5 lb. per 100 gallons of water, the average height of the trees was 7 ft. 4 in., and the average span of limbs 8 ft. 9 in.

Other details of the experimental method were similar to those described above.

RESULTS.

Increase in volume delivery increased the amounts of spray residue remaining on the fruit and foliage (Fig. 2). Study of the plots indicated that the increase in spray residue was due mainly to the spray contacting with areas previously unsprayed, and, where the fruit was concerned, to the finer droplets of spray coalescing to form comparatively large droplets.

Increase in Time of Spraying with Constant Volume Application.

EXPERIMENTAL METHOD.

Methods similar to those described for the previous experiment were used. The time of spraying was varied for each plot. By adjusting the size of the disk aperture in the nozzles, volume

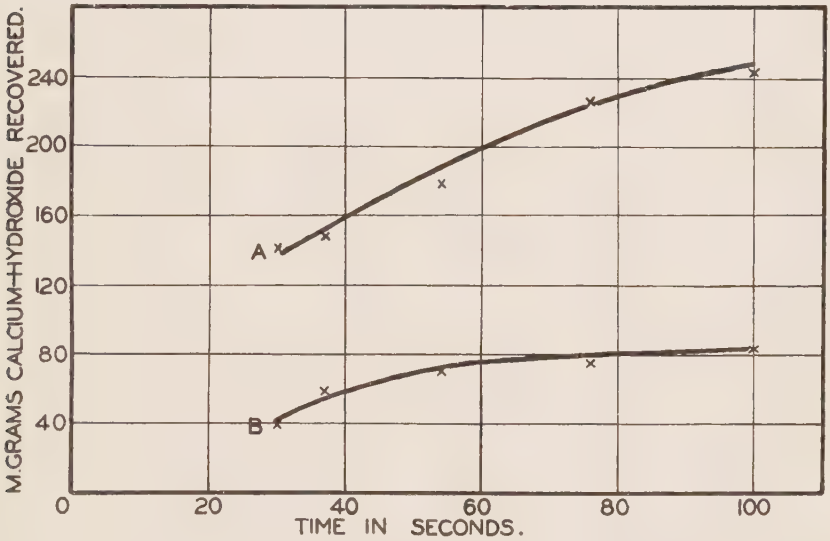

FIG. 3. EFFECT OF INCREASE IN THE TIME OF SPRAYING ON THE AMOUNT OF SPRAY RESIDUE ON (A) LEAF-SAMPLES AND (B) FRUIT-SAMPLES.

delivery was varied inversely with the time of spraying so that each tree received the same volume of spray. The minimum spraying-time per tree was 30 seconds and the maximum 100 seconds, the volume application being 240 fluid oz. (1·5 gallon) in each case.

The hydrated lime was used at approximately 6 lb. per 100 gallons of water where leaf-samples were taken and at 6·25 lb. per 100 gallons of water in the experiment in which the residue on apples was estimated. In the former experiment the average height of the trees was 7 ft. 10 in. and the average span of limbs 8 ft. 11 in., while in the latter experiment these measurements were 9 ft. 3 in. and 9 ft. 9 in. respectively.

RESULTS.

As the time spent in spraying was increased, the amounts of spray residue recovered from samples of leaves and fruit increased (Fig. 3). Where spraying was rapid it was observed that certain areas were left

unsprayed. With increase in spraying-time greater opportunity occurred for directing the spray over all parts of the tree, with the result that better coverage was obtained.

Variation in Volume Delivery as affecting Codling-moth Control.

Experimental Method.

Forty large Ballarat trees, approximately 18 ft. in height were sprayed in ten plots of four trees per plot. The volume of spray applied to the trees of each plot was varied by adjustment of the volume delivered at the nozzles, the minimum volume being 0·8 gallons per minute, and the maximum 4·7 gallons. Nozzle pressure varied from 275 lb. to 300 lb. per square inch.

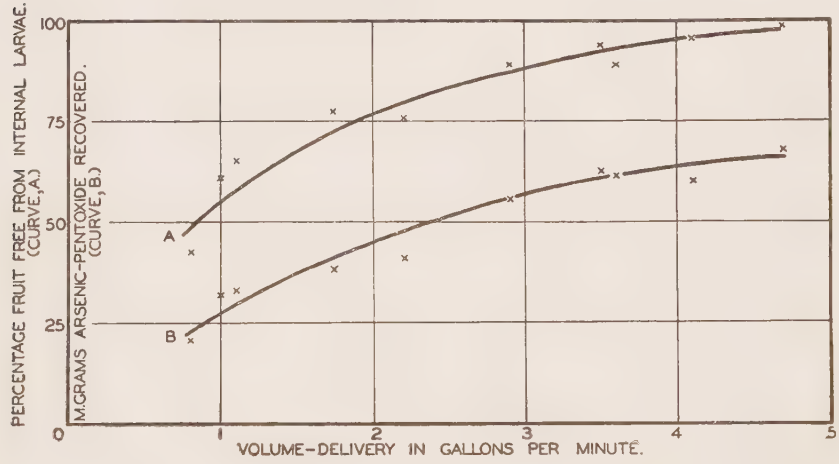

FIG. 4. EFFECT OF INCREASE IN VOLUME DELIVERY OF (A) CODLING-MOTH CONTROL AND (B) ON THE AMOUNT OF SPRAY RESIDUE ON LEAF-SAMPLES.

Owing to differences in tree size, a standard time for spraying each tree was not adopted. However, a constant speed of working was maintained so that the time spent in spraying varied directly with tree size.

Lead arsenate, 1½ lb. per 100 gallons of water, was applied at intervals of eighteen to twenty days from the 30th October to the 6th February.

Both windfalls and the picked crop were recorded, the fruit being divided into (i) clean or superficial damage only, and (ii) internal codling larvæ.

In order to correlate measurements of codling-grub damage with variations in spray residue, leaf-samples were taken as in the previous experiments, and the amounts of arsenate residue measured by chemical analysis.

Results.

As volume delivery was increased from 0·8 gallons to 4·7 gallons per minute, increased control of codling-moth was obtained, the percentage of apples free from larvæ increasing from 43 to 99 (Fig. 4, curve A).

Chemical analysis showed that spray residue increased as volume delivery increased, with a close correlation between increase in spray residue and codling-moth control (Fig. 4, curve B).

Variations in Volume Delivery as affecting Black-spot Control.

EXPERIMENTAL METHOD.

Twenty medium-sized Sturmer trees, approximately 11 ft. in height and 12 ft. in span of limbs, were sprayed in five plots of four trees each. Volume delivery was varied from 1 to 3·5 gallons per minute. Similar speeds of working were maintained as in the previous experiment. The nozzle pressure varied from 250 to 300 lb. per square inch.

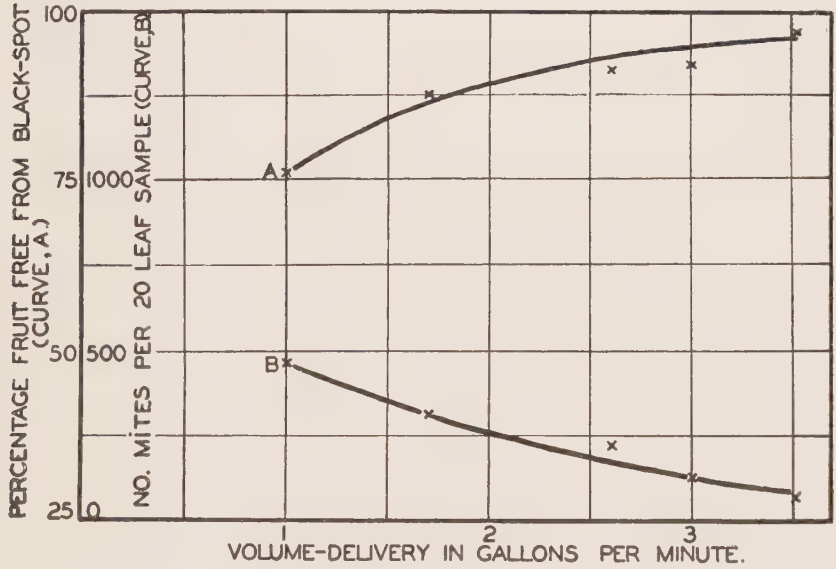

FIG. 5. EFFECT OF INCREASE IN VOLUME DELIVERY ON (A) BLACK-SPOT AND (B) RED-MITE CONTROL.

The spray-mixture consisted of lime-sulphur 0·1 per cent. poly-sulphide content and colloidal sulphur paste (50 per cent. sulphur by weight) 2 lb. per 100 gallons. The mixture was applied at eighteen- to twenty-day intervals from 2nd November to the 14th February, foundation sprays being the same for all plots.

Thinnings, windfalls, and picked crop were sorted into two groups consisting of (i) clean fruit and (ii) fruit showing one or more black-spot lesions.

RESULTS.

Increase in volume delivery from 1 to 3·5 gallons per minute resulted in increased black-spot control. Improvement in control was greatest as volume delivery was increased from 1 to 2·5 gallons per minute, and became less marked beyond this point (Fig. 5, curve A).

Variation in Volume Delivery as affecting Red-mite Control.

EXPERIMENTAL METHOD.

The block of trees used was the same as that of the previous experiment, and the general procedure, including variations in volume delivery, identical. To determine approximately the degree of infestation, the numbers of mites on twenty leaves taken at random from each plot were counted before the oil-spray was applied. For the control of red-mite a summer-oil (approximately 85 per cent. oil) at 1 part in 100 parts of water was applied on the 19th January. Records of the numbers of mites remaining alive were taken on 23rd January. Differences between the various plots were determined by counting the number of mites on twenty leaves taken at random from each tree. Duplicate counts on individual trees showed that although the number of mites per twenty-leaf sample varied, the differences were insufficient to affect the significance of the results.

RESULTS.

Prior to the application of the oil-sprays the number of mites per twenty-leaf sample varied from approximately 4,000 where the volume delivery of the previous sprays had been lowest—*i.e.*, 1 gallon per minute—to approximately 2,000 where volume delivery had been highest—*i.e.*, 3·5 gallons per minute.

The numbers of mites on each twenty-leaf sample remaining alive after the application of oil-sprays varied from 460 where volume delivery was lowest to fifty where volume delivery was highest, showing that increased control was obtained as volume delivery was increased (Fig. 5, curve B).

Discussion.

The experiments show that spray coverage and disease-control are markedly influenced by volume application. When considered in conjunction with the variations in volume delivery known to occur in orchard practice, it would appear that in many instances incomplete spray coverage is obtained. Field observations bear out this conclusion, for where successful disease-control is not obtained with the standard spray programmes* it is usually found that the volume application of spray is insufficient.

Variation in the two factors which determine volume application—time of spraying and volume delivery—both affect spray coverage. The time spent in spraying is a variable factor in practice, being influenced mainly by tree size and to a lesser extent by the standards set by different men when spraying. Efficient disease-control, however, is largely dependent on the rapidity with which a coverage of spray can be obtained over the whole orchard at critical seasons. For practical purposes the time spent in spraying may be therefore defined as the maximum working-speed. Under these conditions volume delivery becomes the significant factor determining volume application. These

* See "Control of Orchard Diseases and Pests by Spraying," *N.Z. Dept. Agric. Bulletin 61.*

experiments indicate that for general orchard-spraying the optimum volume delivery is from 3 to 3·5 gallons per minute. For large trees a volume delivery of from 4 to 4·5 gallons per minute could be used with advantage.

Nozzle Construction and Nozzle Pressure.

The application of a sufficient quantity of spray is not alone sufficient to assure maximum coverage unless the construction of the nozzle and the nozzle pressure are such that the spray is distributed over a wide area. The significant factors in this respect have been discussed previously when dealing with spray nozzles. (See this *Journal*, Vol. 53, p. 68; Vol. 54, p. 71, p. 267).

Ideal coverage is obtained when the spray is deposited as fine droplets so close together as to leave a continuous cover of spray residue. It has been shown, however, that such a cover is impracticable, since the volume of spray required to saturate the trees is such that the droplets of spray coalesce and run-off occurs. The coverage secured after run-off has occurred varies from comparatively large isolated drops of spray to an almost complete cover of fine droplets, depending on the nature of the surface sprayed and on the conditions under which the spray is applied.*

Experiments were carried out to determine the significance (1) of variations in the conditions under which spray is applied, such as the fineness of the spray-droplets formed by the nozzles, depth of penetration, &c., and (2) of variation in the nature of the surface sprayed.

Experimental Methods.

Apples of approximately equal size were removed from the trees and arranged in rows of nine with the stems uppermost. Each group was sprayed until considerable run-off occurred, and, after reversing the stand, the opposite of the apples treated in the same manner. Treatment of different groups was varied—(1) By adjusting nozzle pressure from 100 lb. to 300 lb. per square inch; (2) by whorl-plate adjustment to vary the fineness of spray-droplets and the depth of penetration; (3) by adjustment in the distance of the nozzle from the fruit. Each experiment was carried out in triplicate. The spray was composed of 4 lb. lead-arsenate in 100 gallons of water.

Differences in cover effected by the various treatments were ascertained by observation, and in some instances by chemical analysis of spray residue. It was found that spray tended to collect to a varying extent in the depression surrounding the stem, and, since this did not represent normal coverage, the stem and portion of the skin was removed from each apple before the quantity of spray residue was estimated. The fruit was thoroughly washed before treatment, and unsprayed samples included for analysis with each experiment.

† The types of cover discussed in the present paper are those formed in the absence of commercial wetters or spreaders.

In order to determine the influence of variation in the nature of the surface sprayed, mature plums and peaches were included in the different treatments.

RESULTS OF EXPERIMENTS WITH APPLES.

(1) *Nozzle pressure.*—Increase in nozzle pressure from 100 lb. to 300 lb. improved the distribution of spray on the fruit, the size of the droplets of spray being reduced but the number considerably increased. When the nozzle was held at a distance of 2 ft. from the apples it was found that draught from high pressure tended to remove the droplets of spray from the sides of the apples farthest from the nozzle. This effect was reflected in the measurements of spray residue, which showed an average per group of apples of 3·3 mg. arsenic-trioxide at 100 lb. pressure and 3·1 mg. at 300 lb. pressure. With increase in the distance between the nozzle and fruit the blowing effect of high pressure was reduced, an experiment with the nozzle 4 ft. from the fruit showing an increase in spray from 3·65 mg. at 100 lb. pressure to 4·7 mg. at 300 lb. pressure.

(2) *Whorl-plate Adjustment.*—Adjustment in the whorl-plate so that the spray formed was varied from relatively coarse droplets with high penetration to fine droplets with inferior penetration resulted in improved coverage, the difference being apparent in a reduction in the size and increase in the number of spray-droplets remaining on the fruit. The average amount of arsenic-trioxide recovered from the group of apples was increased from 3·7 mg. where the spray applied was of relatively coarse droplets with high penetration to 3·5 mg. where the penetration was lower and the droplets of spray finer.

(3) *Distance of Nozzle from the Fruit.*—Increase in the distance of the nozzle from the fruit up to 8 ft. resulted in improved coverage. At the greater distances certain of the droplets of spray remaining on the fruit became comparatively large in size before run-off occurred, whilst in the intervening spaces fine droplets of spray remained to form an almost complete cover. Estimation of spray residue showed that the average amounts recovered per group of apples increased from 3·1 mg. when spraying at 2 ft. to 4·7 mg. at 8 ft.

RESULTS OF EXPERIMENTS WITH PLUMS.

Differences in spray coverage resulting from the various treatments were similar to those obtained on apples. In each treatment, however, the coverage obtained on plums was inferior to that on apples.

RESULTS OF EXPERIMENTS ON PEACHES.

In these experiments two distinct types of cover were obtained—(1) That in which the spray remained as drops resting on the hairs covering the fruit; and (2) that in which the spray penetrated between the hairs and formed a continuous film.

The former type of coverage was obtained where a spray of fine droplets with poor penetrating-power was used.

Increase in pressure, adjustment in the whorl-plate to produce a more driving spray, and reduction in the distance between the nozzle and fruit all assisted towards obtaining the latter type of coverage.

DISCUSSION.

It is apparent that spray coverage is largely influenced by the conditions under which the spray is applied and by the nature of the surface sprayed. Variation occurs not only in the distribution of the spray, but in the total quantity of residue remaining on any given area.

On surfaces which are rough—*e.g.*, bark, pear fruits of certain varieties, &c.—it is relatively easy to obtain a continuous cover of spray.

Where the surface sprayed is smooth—*e.g.*, most apple fruits—the spray remains on the fruit as isolated drops, relatively large in size, with the adjacent spaces filled to a varying extent with finer droplets. It was not found possible to obtain a continuous cover of spray on a smooth surface other than by the aid of wetting or spreading agents. Improvement in cover is obtained by the use of a nozzle (or combination of nozzles) forming fine droplets of spray and by applying the spray under high pressure (250 lb. to 300 lb.) with the nozzle held sufficiently distant from the fruit to avoid removal of spray by the blowing effect of high pressure.

"Waxy" surfaces such as the surface of most plum fruits are difficult to cover effectively. The best results are obtained under conditions similar to those applying to "smooth" surfaces, but even under the most favourable circumstances the coverage is often poor, the drops of spray being isolated with comparatively large areas apparently free of spray.

The "hairy" type of surface, represented by peach fruits, can be covered with a continuous film provided the spray is applied with sufficient force to penetrate between and wet the hairs. For this purpose a nozzle giving a relatively coarse spray with high penetration is required. Maximum nozzle pressure should be maintained and the spray applied with the nozzle held as close as possible to the fruit.

METHOD OF APPLICATION.

The attainment of maximum coverage is largely dependent on the personal efficiency of the operator. As a rule the more exposed parts of the tree are rarely missed, and in order to assure that those parts which can be less easily seen are covered it is essential that the spray be applied systematically and from as many directions as possible.

The most satisfactory results are obtained by completing each tree before commencing the next. In some instances, however, the method adopted is to work along a row of trees, spraying half of each tree, and to complete the spraying from the other side of the row. The latter appears to reduce the amount of walking required, but unless carefully carried out may result in parts of the tree being left unsprayed.

The structure of the trees as influenced by pruning methods is of considerable importance in determining the efficiency of application. The main points of significance in this respect are that the centres of the trees should be kept open, the presence of duplicate leaders avoided, and the laterals well spaced. Early thinnings of the bunches so that not more than two fruits are left together assists in obtaining maximum coverage.

CARE IN DRENCHING SHEEP.

By L. W. N. FITCH, Veterinary Laboratory, Department of Agriculture, Wallaceville.

DURING the past months there have come to our notice several cases of abscess formation in the lower jaws of sheep. In many cases a fair number of sheep have been affected in a single flock, and the trouble has caused much consternation in some cases where valuable sheep were involved, as the condition is not infrequently followed by death.

These outbreaks have not been confined to any single area, and it has been found that they are in all cases preceded by the use of an automatic drenching-gun. These guns have in some cases a very rough nozzle (due to being bitten on by sheep) and this, in some cases, in combination with incorrect drenching technique, has been responsible for damage to the delicate lining membrane of sheep's mouths. In addition, a certain amount of the drenching-fluid may be forced into the tissues causing still further damage.

In addition to the damage as described above, and still more important, is the fact that the mouth is teaming with bacteria which gain access to the deeper tissues through the abraded surface and multiply there, with the result that abscesses are formed. These abscesses vary considerably in character. Some are very acute and may cause the death of the animal from toxæmia within a few days. These may never burst to the exterior but burrow their way through the tissues, which are destroyed by toxins. One such case seen at the laboratory had actually spread to the jugular vein, the wall of which had given way, with the result that the sheep bled to death. Others may be less acute and may burst under the jaw, when the prospects of healing are much better, of course. Still others may never burst, but, after say ten to twelve days, may be felt as a hard, firm swelling of inspissated pus, which will gradually be absorbed.

The contents of these abscesses varies from a dirty, brownish, watery mixture to a thick, creamy pus, depending on the nature of the infection.

TREATMENT.

The rational treatment is, of course, prevention. This is achieved by careful and correct drenching technique and by taking care that the drenching-gun nozzle is not rough. A picture is appended showing the correct way to drench sheep. The method is as follows:—

The sheep are in a crush or small pen, and the operator stands alongside or astride the sheep. The sheep is allowed to stand as naturally as possible, as excessive restraint only makes the animals struggle. The sheep should not be up-ended on to its rump. The operator holds the sheep with his left hand, the lower jaw being held with the thumb in the interdental space—*i.e.*, between the front and back teeth. The gun is now put into the sheep's mouth from the side, the nozzle run backwards towards the base of the tongue, and the dose delivered. At the time of delivery of the dose the end of the nozzle should rest on the base of the tongue and be directed backwards, and not sideways, at an angle to the jaw. If this is not done part of the dose may be lost, and further, damage may be done the gums

If these simple directions are observed, there should be no damage to the mouth, with a consequent absence of maxillary abscesses. Further, the chances of pneumonia resulting are reduced to a minimum. Curative treatment is of limited value, and consists chiefly in providing good drainage to the abscess by opening at the correct stage, and irrigation with disinfectants. A further aid to prevention may be the addition of a piece of rubber tubing to protect the nozzle.

CORRECT METHOD OF DRENCHING SHEEP.

One must distinguish the above-described condition from another type of abscess sometimes seen in the lower jaws of sheep. These are usually further forward in the jaw and run a longer course. They are due to the penetration of grass-seeds between the teeth and gums, or, in some cases, through the covering skin. The bone itself is often affected in these cases, and the jaw may be greatly deformed. Such cases frequently result in death.

The Fields Instructor, Masterton, reports that a farmer in the Akitio district has been top-dressing his hill-country with super for the past six seasons, doing approximately one-third of the farm annually, and has just completed twice around the property. Previous to top-dressing his carrying-capacity was 1,000 ewes and 1,000 dry sheep, very little going off the place fat. To-day he carries 2,000 ewes (about half to Southdown rams) and 200 dry sheep, all surplus going away fat.

COMB HONEY.

ITS PRODUCTION AND MARKETING.

H. F. DODSON, Apiary Instructor, Palmerston North.

THE production of comb honey is generally regarded by beekeepers with disfavour or indifference. This is associated with production and distribution problems. Two smaller problems are the reluctance of bees to undertake this particular form of storage and the lack of skill on the part of the apiarist to deal with the bees' reluctance. For these latter reasons, many amateur beekeepers eschew comb-honey production. The indifference of the commercial man, however, lies in the former and less easily surmounted obstacle—distribution.

The commercial apiarist realizes the difficulty—almost the impossibility—of selling large quantities of comb honey in sections—and present-day prices demand a large turnover in any form of honey. He also knows that sections require very careful handling and packing. If one breaks, it is usually in the top row that this occurs, and it then weeps honey all over the cappings of the undamaged sections below.

The main problem of production is the weather. A rapid and constant flow is very necessary for raising first-class sections. It is true, however, that a good average season for extracted honey will usually yield a good average crop of comb honey, provided the hives are in a fit and proper condition.

There is a potential market for comb honey in New Zealand. A large section of the community prefers honey in this form and some will take no other kind of honey. But haphazard methods will bring no results.

Honey in the comb is regarded by many people as being honey in its most natural condition. Without any doubt it is the most natural form of honey. The extracting and tinning of honey is a comparatively modern process, and one that has been evolved to meet a larger need—an ever-growing demand for honey in a cheap and serviceable form. The mass production of honey is filling that need.

But honey in the comb remains the unchallenged choice of the epicure ; and, no matter how fine the grain and flavour, nor how beautifully designed the tin and its label, extracted honey can never enter the same class as comb honey. Honey that has been stored by the bees and sealed at exactly the right moment, honey that has been in contact with nothing but the flowers of its origin and the bees who gathered it as nectar, storing and sealing it in the waxen cells of their own manufacture—such honey bears its own seal of purity.

The fundamental difference between the raising of sections and the production of extracted honey is that, whereas the bees like straight comb, they intensely dislike sections. In drawing out full sheets of foundation, the bees are able to cluster to their hearts' content. The drawing-out of sections, however, involves the breaking-up of the cluster into smaller ones, only a few inches square. The bees' dislike to this arrangement is a perfectly reasonable one, because the secretion of wax by their wax glands depends on the heat they are able to generate. The bigger the cluster, the greater the heat.

The key to the whole business so far as the apiarist is concerned lies in that one central fact—the bees must be induced to want to cluster on the sections. If the bees' problem is that the breaking-up of their cluster reduces the heat, then the apiarist must see to it that there are sufficient numbers of bees in the hive to build up a solid wall of reserves behind these divided clusters for relieving them and for maintaining the temperature in the super. At the same time it is also important to see that the hive is well above the ground, allowing a plentiful supply of fresh air to circulate. Heat in this case must not be confused with stuffiness, which will cause swarming more quickly than anything.

Hives that are to yield a good crop of first-class sections must be strong colonies with a large force of young bees as well as a good foraging force. The first step, then, is to build up a powerful colony from a young and vigorous queen that will keep the hive well stocked. Assuming the colony to have been wintered in one box, it should be built up during the spring into two boxes full of brood and bubbling over with bees. All emerging brood and the queen should be kept in the bottom box, only eggs and very young larvæ being allowed in the second box; the two outside combs may be empty. Any emerging brood over the ten frames should be given to other hives requiring them. As the bees hatch out, the queen has room to lay, and the bees have the two outside frames in the second box in which to store any honey that may come in.

In districts where there is an early flow of dark honey, it is very sound to add a super as soon as the flow starts. This may be judged by the whitening of the tops of the combs. The bees take possession of a super of drawn comb very readily as honey starts to come in, and a super of dark honey makes excellent feed and develops in the bees the idea of storing upstairs. The brood manipulation already referred to keeps the queen below, and as the flow develops into a better quality the hive is approaching a condition where good habits are being practised.

The next step is concerned with creating a desire in the bees to draw out the sections. There are many and varied plans for doing this. The late Dr. C. C. Miller, one of the most successful producers of comb honey, used what he termed "go-back" sections to act as baits. That is to say, he used to put unfinished sections from the previous year in with the undrawn sections to tempt the bees into the super. For those intending to take up section-raising Dr. Miller's book "Fifty Years among the Bees" can scarcely be equalled.

Jay Smith, an eminent American beekeeper, uses a system of raising sections and extracting combs in the same box. This is an excellent plan, and should commend itself to New Zealand beekeepers where the vagaries of the weather are so pronounced.

An ordinary section super holds seven frames. One of these should be removed; on each outside an extracting-frame containing fully drawn, empty comb should be placed. This super is then ready to be added. Immediately this is given to the bees that are crowded for space they start to store in the two outside combs. They are thereby instantly attracted to the fresh story: they start to occupy it at once and to work in it at once. As the season opens up they fill and seal the outside frames, and, working on to the section frame next to it,

gradually extend towards the centre. Of the numerous methods used and advocated, this is the simplest and appears to bring the best results.

As soon as it is filled, the super of early honey can be taken off and replaced with the prepared super of sections. If a half super is used, the clusters that were working on the super just removed are forced into half the space. This is advantageous, as it gives that extra concentration so necessary for sections. Another advantage is that a half super takes only half the time to complete. This means that the sections are on the hive only half the time, and in consequence do not become so travel-stained.

The machinery of distribution cannot be dealt with adequately in this article, but the following outline of possible action is designed to give some guidance.

The first thing to realize is that people do want comb honey, and if people want a thing they are usually prepared to pay for it.

If people want to buy something, a merchant is immediately interested, but he has to be satisfied that they really do want to buy and will keep on buying.

The beekeepers have their own commercial organization which exists for the purpose of distributing honey to people that want it. But before such an organization can be utilized, the producers have to show conclusively first that they can and will produce, and, secondly, that, having produced, there will be no difficulty in disposal.

The first step in this direction is co-operation. The beekeepers in a given area should combine and produce comb honey, packed in cellophane with a cardboard container, and standardize their quality and price. The commodity must be standard, of high quality, and an attractive pack. A distributing organization would willingly handle such a commodity.

In favour of extracted honey we have an additional tonnage and the retaining of the comb and the cappings. The amount of labour involved is, contrary to the general notion, about equal, unless the producer exports all his honey in 60 lb. tins, in which case labour is a larger cost in the case of sections.

It is difficult to determine accurately what crop of sections in ratio to a crop of extracted honey may be taken in any given season. The ratio alters according to the length and quality of the flow. In a first-class season the crop of sections would be much nearer the extracted crop; in a poor season, yielding no sections, a fair crop of extracted honey might be gathered. The capital outlay required for running a few hives for comb honey is far less than that required for equipping an extracting house.

Finally, as the production of comb honey is still in its infancy, a word of caution seems warranted. It would not be wise for any one at this juncture to produce comb honey too extensively. The purpose of this article is to demonstrate that comb honey can be successfully produced under normal conditions, and that there is a potential market capable of absorbing large quantities. The apiarist who desires to pioneer this comparatively unexplored branch of the honey industry must be prepared to build up from small beginnings, either by himself or in conjunction with other apiarists, the production of a first-class commodity and a collateral suitable marketing organization.

SEED-WHEAT CERTIFICATION.

THE following is a list of growers for the month of May whose wheat crops have passed both the field and grain inspections required under the Government scheme for the certification of seed wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed and the sacks suitably sealed and tagged. (Previous lists, to which those interested are referred, appeared in the March, April, May, and June *Journals*) :—

Variety.	Grower.	Acreage.
Cross 7	Brophy, K.	13
	Forster, J., Washdyke	6
	Henderson, W. L., Teschemakers, Waimate, R.M.D.	15
	Kean, C. A., Limehills	3
	Pemberton, S., Winchester	30
	Talbot, C. J. and G. W., Fairlie ..	19
	Talbot, P. R., Claremont, Timaru (Line A)	30
	Watson, D. M., Methven	11
Dreadnought ..	Medlicott, F. S., Hook	10
	O'Sullivan, E. D., Park Road, Albury ..	16
	Ruddenklau, H., Estate of, Waimate ..	20
Hunters II ..	Ford, W., Eiffelton, R.M.D.	11
	Horsnell, H. S., Morven	8
	Hunter-Weston, R. P., Albury ..	9
	Miller, P. H., Fairlie	10
	Ruddenklau, H., Estate of, Waimate ..	32
Solid Straw Tuscan	Brunton, D., Otaio	30
	Darling, S., Seadown	6
	Dickson, A. M., St. Andrews	8
	Gosling, A., Claremont, Timaru ..	10
	Henderson, W. L., Teschemakers, Waimate, R.M.D.	15
	Lynskey, M., School Road, Yaldhurst ..	14
	Lysaght, T., Tripp Settlement, Geraldine (Line B)	10
	Medlicott, F. S., Hook	12
	Ross, C. E., Laghmor, Ashburton ..	20
	Tozer, W. J, Rangitira Valley, Temuka ..	12
	Waller, G., Tripp Settlement, Geraldine (Line B)	7

—*Fields Division.*

The Sixth Conference of the New Zealand Grassland Association will be held in Dunedin on August, 10th, 11th, and 12th. Non-members as well as members are invited to attend. The subscription of membership is 5s. per annum.

Use of Cow-shed Wastage.—The matter of utilizing droppings and washings from sheds and yards is receiving considerable attention : already fifteen plants are all working satisfactorily, and good results are being secured from the operation. An estimated cost of the outlay is as follows : Sump, 500-gallon capacity, cement-lined, own labour, £7 ; hand pump, 6 ft. lifts 1½ gallons per stroke, £4 17s. 6d. ; tank, painted, £6 ; sledge, complete with fittings, £10 10s. (drawn by one horse, or two in wet weather : total, £29 (approximately). One farmer with a 110-cow herd in one shed runs the washings straight into his tank and spreads them every day ; but most men provide a sump of 500 to 2,000 gallon capacity and top-dress when convenient. Odd cases of trouble over grit carried in on the hoofs of animals affecting pump-washers are reported ; but one man has installed a diaphragm pump costing £15, which is doing good work.—*Instructor in Agriculture New Plymouth.*

SEASONAL NOTES.

THE FARM.

Bearing of Pig-keeping Position on Cropping Programme.

FOR the present at least the United Kingdom is practically the only export market for New Zealand pig products. The present position has not changed materially from what it was in 1936, when the United Kingdom imported 363,124 tons of bacon and hams, 5,800 tons of fresh pork, and 51,400 of chilled or frozen pork, a total of 419,524 tons of pig products; in the same year the imports of frozen lamb and mutton totalled 315,626 tons.

The 51,400 tons of frozen or chilled pork imported in 1936 included 29,028 tons imported from New Zealand, this being 56 per cent. of the total.

When the quantitative relationship between the pork and the bacon imports of the United Kingdom is taken into consideration, it becomes clear that any substantial increase in the number of carcasses of porker weights exported would involve a distinct danger of over-supplying the market with the usual influence of this upon prices.

In the face of this position greatly increased output of pig products for export by New Zealand is considered both easily possible and highly desirable, but as a glutted market is invariably unsatisfactory to the producer the increased production of pig products to be of the fullest economic value clearly must be correlated with the production of a greater proportion of carcasses of baconer-weight, and the proportion of such carcasses must become progressively greater as our exports grow. In view of the market position it is gratifying that there already is a distinct trend to an increased proportion of carcasses of baconer-weight and slaughterings for export: in 1932–33 there were 53,608 bacon carcasses in a total of 310,389 carcasses, while in 1935–36 the corresponding figures were 219,690 and 679,561 while the position is still better in the elapsed portion of the current producing-year, the figures for eight months to the end of May being 239,162 baconers in a total of 642,669 carcasses.

Practices already being carried out with economic results by certain farmers, if adopted more generally, will enable the present desirable trend in the porker-baconer ratio of production to be intensified when and as this is necessitated by further growth in our pig industry. An important one of these changes is the wintering of store pigs. A report of an investigation by the Manawatu–Oroua Pig Recording and Development Club relative to the wintering of pigs was published in this *Journal* in January last. The investigation covered a period of sixty days in May to July: the initial live-weight of the pigs was approximately 70 lb. (other experience suggests that much smaller pigs would not fare so well), and the pigs made an average daily gain of $\frac{1}{3}$ lb. a pig. The feeding-stuffs used were barley, peas, mangels, pumpkins, and meat-meal. In assessing the feeding-cost of wintering, barley, peas, and meat-meal were charged at 1d. per pound, and roots were charged at 12s. 6d. a ton. The cost of the feed on this basis was 8s. 9d. a pig. The commercial difference in price between a 70 lb. pig in the autumn and the same pig in the spring having grown in the meantime at the rate of $\frac{1}{3}$ lb. daily is always much greater than the sum of 8s. 9d. One point of great practical importance is that pigs wintered in the way described are available to consume very effectively the dairy by-products in the spring and develop to bacon weights relatively early in the new producing-season.

Further, by wintering pigs in this way the farmer often can solve the problem, which otherwise may be difficult, of how to handle satisfactorily second litters within the one year: the proper wintering of pigs mainly on home-grown feeding stuffs is likely to be much preferable either to selling them as somewhat small porkers or as stores at "sacrifice" prices. The rations used in the investigation were—(1) Barley, meat-meal, and pumpkins; (2) barley, peas, and pumpkins; (3) barley, meat-meal, and mangels; (4) barley, peas, and mangels. The principal results are in complete conformity with a considerable amount of practical experience.

Special Crops for Wintering of Pigs.

From the results of the investigation and of considerable supporting practical experience it may be deduced that when the yields of mangels, pumpkins, peas, and barley are tolerably good following a reasonable standard of efficiency in their culture, then these crops may profitably be grown for use in the winter feeding of pigs. Outside the milder northern districts the yields of pumpkins seem as a rule to be too low to justify using the pumpkin in place of the mangel. The mangel may at times not be mature early enough to be fed with safety to pigs when the feeding of roots first becomes desirable. To provide for such a possibility such crops as swedes, chou moellier, and carrots may be grown for use before the mangels have ripened, and in conditions well suited to good yields from these three crops they may quite well be used to displace the mangels largely or even completely.

It is not always realized that home-grown peas and barley can be used very efficiently in pig-keeping without the necessity for outlay on special machinery, such as a binder, which is not part of the regular equipment of dairy-farms, and without the bother and expense of threshing such crops. In actual practice these crops are being harvested quite well by mowing, and pigs being excellent gleaners no wastage of consequence occurs when they are given unthreshed peas or barley.

In the warmer districts, where reasonably good yields from barley and peas cannot be depended upon, experience has indicated that maize grain may be used with great success in the wintering of pigs. Full information about the crops that suitably may be grown in specific districts for the wintering of pigs and about the culture and use of such crops may be obtained from local officers of the Fields Division.

In planning the wintering of pigs it should not be overlooked that pastures and kindred crops such as green leafy cereals have frequently been employed with success to contribute a substantial portion of the ration of pigs. Further, success from pastures and kindred crops used in this way cannot be expected unless the crops are at a leafy as distinct from a stemmy stage of growth and unless they are available in adequate amounts. Pigs may be grazing on leafy pastures which are grazed so closely that the pastures actually contribute very little to the daily ration, and in such circumstances poor results may be expected.

Breaking-up of Pastures.

A most important question that arises at this stage in the year's work is the acreage and location of the grassland it is advisable to put under the plough during the coming season. One of the main matters that should be given consideration in deciding the answer to this question is what area of special crops—such as mangels, swedes, turnips, chou moellier, carrots, and cereals—it is desirable to grow to ensure adequate supplies of feed when that available directly from grassland is likely to be below the requirements of stock during the critical periods in late summer and in winter and early spring. This should be considered in conjunction with the area it is proposed to utilize for hay and silage. Of considerable practical importance in connection with the provision of special feed is the fact that generally the

provision made for the critical seasons is less than is required for full economic feeding of stock, and that, especially in dairying, but also in sheep-farming, there often would be more profitable results were the plough used more freely as a step towards better feeding during those periods when the feed from pastures usually is too scant.

Another important matter sometimes ignored is that breaking-up of pastures may be the most economic course to adopt when the improvement of inferior swards is sought. This matter was dealt with at some length in these notes last month.

Pastures Inferior to Their Natural Conditions.

Quite frequently pastures are of lower production than is warranted by the natural conditions under which they are growing. Expressed otherwise, often the land is capable without the aid of such practices as top-dressing or draining of supporting more productive pastures than the existing ones. There are three common causes of this state of affairs—(1) Ravages of the grass-grub ; (2) use of inferior strains of pasture species ; (3) grazing management which leads to deterioration and lessened production of swards.

The ravages of the grass-grub are obvious, and at this season they call for the feeding-out of hay, silage, &c., on affected areas, and especially for the feeding-out of any hay in which useful plants contain seeds mature enough to be viable. Further, if the land responds to any form of top-dressing, then that form of top-dressing is advisable for the purpose of increasing the vigour of plants and stimulating their recovery from root-damage. However, so far, no type of top-dressing—*e.g.*, with lime salt, &c.—as a direct means of attacking the grubs has been found of value.

The use of inferior strains of pasture-plants which either are not persistent or are of low production, even under conditions of high fertility, is a frequent and fruitful cause of poorer pastures than the natural conditions warrant. The remedy is simple and normally can be carried out at a cost which makes its adoption distinctly profitable : it is the use of seed of the characters possessed by certified seed.

The most usual type of grazing management which leads to deterioration and lowered production of pastures is unfortunately very common ; it is that in which unduly hard grazing takes place continuously in the winter and early spring and this is followed by insufficiently close grazing for most of the early summer. This type of grazing results in the punishment at a critical stage in each year's activity of species which make early growth—*e.g.*, rye-grass—and of the strengthening of species which make late growth—*e.g.*, brown-top. This tends to the eventual dominance of the brown-top and the suppression of the rye-grass. Ordinarily such a result is most readily avoided by one or both of two distinct courses—(1) Increased ensilage or haymaking which each reduces the summer surplus and builds up the winter feed-supply so that it tends to correct the grazing fault at both seasons ; (2) the growing of special arable forage crops for use in winter, which likewise tends to correct both grazing faults.

From the preceding brief outline it becomes evident that the whole pasture position on individual farms may very fittingly be reviewed at this stage in the year's work if it has not already been done ; the field work that should be done during the next few years and especially during the next twelve months should depend to a considerable extent upon the current general position on the farm in regard to grassland.

Care in Winter Grazing.

Young pastures, and especially those in which permanency is desired, should be treated with much care at this season. "Poaching" or "pugging" leads to bare patches by means of which weeds gain a footing—

it is at times the primary cause of great numbers of such weeds as docks, buttercups, daisies, and thistles suddenly appearing. Sheep lessen the danger of "pugging" in comparison with cattle.

In trying to avoid "pugging" of young pastures one may fall into another fault—unduly lenient grazing—which readily brings about weakening of valuable species such as clovers. Young permanent pastures containing a considerable amount of Italian rye-grass are very prone to suffer from under-grazing because of the shading effect of the rye-grass upon the more slowly developing species. The other fault—over-severe grazing of young pastures—is in August the more prevalent one: it results in a setback to valuable species from which they may never recover fully.

General Cropping Work.

In the main grain-growing districts the ploughing of land for cereals should take precedence over almost all other work. As a rule the best yields of spring wheat result from sowing in August and early September. The sowing of oats ordinarily should follow wheat as soon as opportunity offers.

Seed-treatment for disease-control of spring-sown cereals should not be omitted. The treatment of seed of oats and barley is more neglected than that of wheat, but nevertheless is well justified. Recent years have been marked by advances in seed-treatment associated with increased convenience and safety without sacrificing efficiency and economy, but strangely enough the advances in our knowledge are far from generally applied in practice. It is of importance that certain popular forms of seed-treatment must be carried out with exactitude. If the proper procedure is not followed carefully, one of two undesirable results is likely: either the disease is not controlled or the seed suffers injury. Sometimes injury is so extensive as to lead to the need of resowing or to a poor yield or to both resowing and a poor yield. Detailed information about seed-treatment is available from the Department of Agriculture.

Autumn-sown cereals if they are to produce chaff or grain should be given a final grazing about the end of August. However, if because of the high fertility of the land "lodging" is expected, then the final feeding-off may quite well be deferred until September. Generally after the final feeding-off the crop may with advantage be tine-harrowed to loosen the surface and to distribute droppings as thoroughly as possible Feeding-off of cereals in the spring should be done by heavily stocking the area for a short period, and this preferably when the soil is as dry as possible. Harrowing of autumn-sown wheat may serve usefully to thicken thin crops, even when they have not been eaten off, by promoting tillering.

Winter Utilization of Crops.

Faulty winter feeding often results when rations are not suitable in quality as well as quantity. It is not enough merely to provide a ration which fills the stomach—the required amount of nutriment should also be present. The feeding of stock mainly on straw or poor hay may be expected to result in poor nutrition, because the diet thus provided is too bulky in relation to its content of digestible nutritive matter. The feeding of roots alone leads to too much watery bulky material in the animal's diet. While it is mainly the bulkiness of roots which makes them unsuitable as a complete diet, straw and poor hay are unsuitable because both of their bulkiness and low digestibility.

If possible, grazing of lucerne during winter and early spring should be avoided: this is especially so in the case of young lucerne. Such grazing promotes the invasion of the lucerne by other plants, which, even if of some value—*e.g.*, rye-grass and clover—must be looked upon as weeds in the lucerne.

If any pastures are showing signs of grass-grub damage, but are not so extensively damaged as to be not worth repairing, then during the next few weeks the feeding of hay, silage, and roots may usually be concentrated

profitably on them: at this stage the grass-grubs return to near the surface from considerable depths, and so they are more subject to injury by the trampling of stock. Further, the trampling and the extra fertility induced by the feeding-out seems to be of value in assisting injured plants on which remnants of roots remain to recover more readily.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Pruning.

EVERY endeavour should be made to complete this work as early as possible so that it will be finished before the spring activities—cultivation and spraying—are commenced. With regard to pruning, following the advice given in the notes of the previous months, those who have any difficulty in respect to the manner in which any particular trees should be pruned are advised to communicate with the Orchard Instructor stationed in the district and seek his advice.

All prunings, orchard refuse, and rubbish should be gathered and buried, either as the pruning proceeds or immediately it is finished. This is the surest and best way of destroying any pests and diseases of the trees which may be present in such materials.

Spraying.

The overhaul of the sprayer before the spraying-season commences will save growers much loss of time and inconvenience later in the season. A thorough examination should be made of the machine, and all damaged or worn-out parts should be repaired or replaced. The moving parts of the pump and engine should be thoroughly cleaned and regreased. Examine and test the hose, and if faults are found new hose should be obtained. A supply of spare parts for repairs in case of emergency during the season should be obtained.

The fruitgrower has to contend with a large number of pests and diseases. Some of these cause extensive damage to the trees and the crops. Every grower should make a determined effort to decrease the amount of disease present in his orchard by orchard sanitation and spraying.

The first essential in treating insect or fungous disease is that the grower should identify correctly the pest and know something of its life-history in order that it may be correctly classified and the proper remedies applied for its control. After becoming acquainted with the life-history the orchardist has to consider and decide on a remedy which can be effectively applied. The remedies most commonly applied are briefly as follows:—

(*a*) *Poisons for Chewing or Biting Insects.*—An arsenical poison—arsenate of lead—which acts upon the stomach is the specific in general use for the control of codling moth, leaf-roller caterpillar, and pear or cherry slug, &c. These should be applied to the foliage and fruit just before the pest makes its appearance.

(*b*) *Contact Sprays for Sucking Insects.*—The insects must be present when these sprays are applied, and the specifics are most efficient when they come in contact with the bodies or are inhaled through the breathing organs of the insects. At the present time lime sulphur, nicotine sulphate, winter (red) oil, and summer (white) oil are in most general use as contact sprays for the control of red mite, apple-leaf hopper, green and black aphis, and scales.

(*c*) *Fungicides for the Control of Fungi.*—The specifics should be applied before the spores of the disease have an opportunity of germinating and establishing themselves on the plant or fruit tissue.

Lime sulphur, bordeaux mixture, and colloidal sulphur are the fungicides in most common use for the control of black-spot, powdery mildew, leaf-curl, brown-rot, rust, shot-hole, and other fungous diseases.

(*d*) The use of the secateurs and the saw is recommended for the cutting-out, where practicable, of parts of trees badly damaged by insects, fungi, or bacteria.

Cultivation.

If the land has not already been ploughed, every effort should be made to complete this work as soon as possible, so that cover-crops, grass, and fallen leaves, &c., may be turned in. This will give the crops and other vegetable matter turned in time to rot, and the elements which it contains will be made available when the tree requires them in the summer, when the fruit is maturing. Leaves affected by disease such as black-spot, for instance, will be buried and will have rotted, thus preventing the dissemination of disease from this source during the spring.

Planting.

Growers intending to plant in the spring should arrange for early delivery of the trees, and, on their arrival, they should be "heeled in" in a suitable place at or near the orchard, ready for planting towards the end of August. The ground should be reasonably dry, and, if wet, the planting should be delayed until a later date, when the soil is in a suitable condition.

Fruit in Storage.

This should now be examined frequently. Growers are advised to dispose, without undue delay, of fruit which has begun to shrivel or is showing signs of wilting or over-ripeness.

—B. G. Goodwin, Orchard Instructor, Christchurch.

Citrus Culture.

Packing.—Last month notes on the packing of citrus fruits were given, the main points dealt with being the building of the bulge and the elimination of slackness in the pack. The type of packs used will now be dealt with. In the case of lemons and sweet oranges the fruits are packed on the "cheek" and the style of pack and the counts per box are the same as those used for apples and pears, except that the 3-2, 7-6, 5-layer 163 pack is seldom used, as it is generally not possible to get seven lemons in the rows lengthways. In its place the 3-3, 5-4, 6-layer pack of 162 is used. As in the case of "Small" grade lemons the sizes allowed are 270 to 350 counts to the standard box (10½ in. by 11½ in. by 18 in. inside measurement), the packs in these instances are not included on the apple-packing chart. A lemon-packing chart recommended reads as follows:—

Style of Pack (Crosswise).	Number in Rows (Lengthwise).	Number of Layers (Depth).	Size or Count.
3-2	5-5	5	125
3-2	6-5	5	138
3-2	6-6	5	150
3-3	5-4	6	162
3-3	5-5	6	180
3-3	6-5	6	198
3-3	6-6	6	216
3-3	7-6	6	234
3-3	7-7	6	252
3-3 (*a*)	8-7	6	270
3-3 (*a*)	8-8	6	288
4-3 (*a*)	6-6	7	294
4-3 (*a*)	7-6	7	319
4-3 (*a*)	7-7	7	343
4-3 (*a*)	8-7	7	368

The last six packs marked (*a*) are applicable to "Small" and "X" grades only. Lemons of this size are of little commercial value unless they are highly cured and full of juice.

The method of packing New Zealand grapefruit differs from that used for other fruits in that it is usually packed on the flat instead of on the cheek, and, as this method gives different counts to those obtained in packing in the ordinary way, a chart for use with the standard bushel case, for New Zealand grapefruit (Poorman orange) only, is given below:—

Style of Pack (Crosswise).	Number in Rows (Lengthwise).	Number of Layers (Depth).	Size or Count.	Approximate Diameter.
				Inches.
2-1	3-3	5	45	$4\frac{1}{4}$
2-2	3-2	5	50	$4\frac{1}{8}$
2-2	3-3	5	60	$3\frac{7}{8}$
2-2	4-3	5	70	$3\frac{3}{4}$
2-2	4-4	5	80	$3\frac{5}{8}$
2-2	5-4	5	90	$3\frac{3}{8}$
2-2	5-5	5	100	$3\frac{1}{4}$
3-2	4-3	6	105	$3\frac{1}{4}$
3-2	4-4	6	120	$3\frac{1}{8}$
3-2	5-4	6	135	3
3-2	5-5	6	150	$2\frac{7}{8}$
3-2	6-5	6	165	$2\frac{3}{4}$
3-2	6-6	6	180	$2\frac{5}{8}$

NOTE.—See packs on the flat.

Green Spot.—This condition was described in the notes for March last, but is referred to again as it has been much in evidence in packing-sheds during the past few weeks. The trouble occurs mostly on green fruit, and is accentuated when picking is carried out when the fruit is wet with rain or dew, although the primary cause is rough handling. Care should be taken to avoid the conditions which are conducive to this trouble, as green-spot lowers the grade of the fruit and consequently its value.

Replacements.—In many of the older groves there are trees which, owing either to the ravages of disease or to the fact that their constitution has been weak, have reached the stage when they are no longer producing a satisfactory crop. Generally these are allowed to remain in the grove far too long. The owner should decide whether there is reasonable hope of bringing the tree into full bearing again by skeletonizing it and by soil-improvement, or whether the tree must be cut out without further delay. If the tree has had root trouble very extensively or if it is almost completely ring-barked through attacks of "bark-blotch," then it should be removed. A young tree should do quite well on the old site provided that a large hole is dug and filled in with fresh soil.

—A. R. Grainger, Orchard Instructor, Tauranga.

POULTRY-KEEPING.

Duck-keeping.

WHEN selecting breeding-ducks the same care and thought should be given as when selecting other breeding-birds. Firstly, select only pure-bred birds A study of the standard plates will indicate the type, while the letterpress thereunder states the breed characteristics. Vigour and constitution should be looked for, and the chief indication of this *sine quo non* is physical activity, together with a bright keen eye and well-developed body.

It is difficult to state a guide indicative of egg-production capacity in ducks, but on the whole it is advisable to select birds that show plenty of

length, with ample breadth and depth. Good breeding-birds usually have large, bold, prominent eyes which are set high up in the head ; in fact, it is seldom that the duck with eyes set low down in the side of the face is a good producer. The neck should be fairly fine. The front should be full with a well-developed abdomen. Slight indentation should show between front and abdomen. Breadth across the back is essential, and the legs must be set well apart. Two points that should be watched are, firstly, that the weight for the breed is kept up, and, secondly, that the length of the body is maintained to standard.

Mating.

Only well-matured ducks should be bred from. As a rule ducks do not mature as early as fowls, but their laying-life is longer than that of the average hen. Two-year-old ducks mated to well-matured drakes at least ten months old will give good results.

As ducks are inclined to get overfat during their second and third years, especially after coming through the moult, they should be fed with care, as lack of care in this direction is often the cause of poor hatching results. The number of ducks to mate with each drake will depend on the conditions under which the birds are kept, their vigour, and age, but, generally speaking, from six to seven ducks to each drake of the Indian Runners or Khaki Campbells, and four or five ducks to each of the heavy breed drakes, should give good results.

Where the birds are on free range, more ducks may be mated with each drake. It is usually an indication that the drakes are under-mated if they fight a good deal. As there is no sure way of judging exactly how any particular mating is going to materialize it is always advisable to take the utmost care to arrange that only the very best and strongest birds are used for breeding purposes. Though many ducks will refuse to lay in nests it is most desirable to encourage them to use nests by supplying them with simple nests, such as a few bricks placed about a foot apart against one wall of their shelter. If a little straw is placed between these bricks it is quite possible to train a number of ducks to use such nests, when their eggs can be collected in a clean condition.

Hatching Duck-eggs.

With the exception of the Muscovey, which take from thirty-five to thirty-seven days, all duck-eggs take twenty-eight days to hatch out, though many chip on the twenty-sixth day. Care should be taken to select eggs of good colour, shape, size, and texture of shell. Avoid the very large, bad-shaped, or rough-shelled eggs, as such eggs seldom hatch. It should be remembered that duck-eggs do not keep as well as hen-eggs, and that they lose their fertility more quickly. For these reasons they should be set within a week from the time of being laid ; in fact, the fresher they are when set the better. If hens are used for hatching purposes not more than from nine to eleven eggs should be placed under each hen. Better results will be obtained when the hen is set on the ground, and during the last week if the weather is dry it is advisable to sprinkle the eggs with a little warm water every other day. The hen can be quietly lifted off and replaced as soon as the eggs have been sprinkled. Care must be taken to see that the eggs are not chilled. Do not overdo the sprinkling, and if the weather is wet and the ground damp round the nest there will be no need for sprinkling.

The best results when hatching duck-eggs artificially are usually obtained when a little less ventilation and heat are allowed during the first week, and more moisture and ventilation during the last week of incubation, than that allowed when hatching hen-eggs.

The machine should be running at an even temperature of 100° F. when the eggs are first placed in the machine, and if the eggs are very cold the door of the machine can be left open for a few hours in order to allow the eggs to warm up gradually. If cold eggs are placed in an incubator and they

are heated up too quickly, a number of broken yolks is likely to be the result. A temperature of 102° F. for the first week, 103° F. for the rest of the period until the eggs start to chip, when 104° F., not higher, may be applied, should give good results. During the last ten days the eggs should be sprayed with a little warm water (about 103°) each day. This can be done either with a small brush or with the mouth. If the eggs are cooled in the morning the spraying should be done at night, but remember not to cool and spray at the same time, as such action will most likely cause the eggs to become chilled.

The incubator-ventilators may be almost closed during the first ten days, after which the ventilators can be gradually opened, but once the eggs start to chip it is advisable to open up the ventilators and not close them as is often recommended when hatching hen-eggs.

Cooling and Turning.

The object of turning the eggs is to prevent the yolks from settling down towards the shell. The eggs should not be disturbed for at least thirty-six hours after placing them in the machine, then turn them once each day during the first week of incubation, and twice each day from then on until they start to chip, which is generally about the twenty-sixth day. It is essential that the eggs be handled gently, as jarring or rough handling is likely to cause deformed or crippled ducklings. As long as the eggs are moved gently it is not necessary that each egg be turned exactly over. It is, however, advisable to move them to different parts of the tray when turning, in order to give all the same units of heat, for all parts of the machine are not always exactly the same temperature.

During the first week the time taken to turn the eggs will be sufficient for cooling them, and then a few minutes extra each day until from thirty to thirty-five minutes are allowed during the last week. If it takes more than an hour and a half to get up the heat again, then less cooling should be allowed. The eggs should not be allowed to get cold, but be returned to the machine while just luke-warm. Never open the machine after the eggs start to chip until they have been given their full time to hatch.

Brooding Ducklings.

Ducklings are not difficult to rear and will give less trouble than chickens, but they must have clean, dry, well-ventilated sleeping-quarters, and a supply of drinking-water within their reach at all times. The drinking-vessels must not be too shallow. The ammonia from damp, dirty bedding and poorly-ventilated sleeping-quarters are the cause of watery or sticky eyes in ducklings, and many young ducklings are lost each year from blind staggers brought on from giving them a drink and a feed at the same time after they have been too long without water. As previously mentioned, if it is found when it comes to feeding-time that their drinking-vessels are empty it is better to give them a drink before feeding, and if the morning is cold the chill should be taken off the water. The food should always be well mixed and not fed lumpy.

When brooding ducklings artificially they need much the same treatment as that given to chickens, but they do not require heat so long, and if it is gradually reduced after the first week they will get on well without heat after three or four weeks, provided they have a dry, clean bed, are not overcrowded, and have ample fresh air.

As is the case with feeding chickens, some duck-keepers have success with one system and others with a different one. A great deal depends upon how one feeds. The following is one method that has given good results :—

The first feed, which is given from thirty to thirty-six hours after hatching, is composed of equal parts of pollard and bran and a little rolled oats or oatmeal plus about 5 per cent. of sand or oyster-shell dust, the lot mixed to a crumbly state with skim-milk. This is fed four times a day for the first five days. From the sixth day add about 5 per cent. of meat-meal and a small quantity

of finely cut succulent green feed or boiled vegetables. After ten days increase the amount of meat-meal or boiled minced meat to 10 per cent., and also increase the amount of green feed. If on hand, maize-meal or barley-meal can take the place of the rolled oats. From two weeks' old three good feeds per day will be sufficient. Give all the brids will eat, but do not allow any food to be left to become sour. After the first week it is not necessary to mix sand with the mash, but it is essential that fine oyster-shell and gravel grit are always within reach of the birds.

When about eight weeks' old it is advisable to pick out the most promising birds for future breeders. Separate and fatten the rest for market by increasing the amount of maize-meal and barley-meal and reducing the amount of green feed. If ducklings have done well they should be ready for market at about eleven weeks old. When fattening for the market they need be given water to drink only at feed-time.

Ducklings must have ample shade from the sun, and the less they are disturbed the better. Ducklings can be hatched later than chicks, but if it is desired that young ones lay during April and May they should be hatched not later than October.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Preparations for New Season.

By the end of August the beekeeper should have his preparations for the season's work well in hand. Hive and frame making, also the overhaul of all defective supers, roofs, and bottom-boards, should be undertaken in earnest. It is not wise to postpone the mechanical part of the work in the apiary until the bees themselves require the major portion of one's time. If increase is desirable—more especially where the apiary is being enlarged—ample provision should be made for it. It is most tantalizing to leave a swarm hanging on a tree while a hive has to be hastily put together.

Where the beekeeper does not make his own hives he should now order sufficient stocks to see him through the coming season. In most cases it does not pay to make one's own appliances. Hive-manufacturing in New Zealand has been brought up to a high standard, and unless the beekeeper has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on these lines. Non-fitting supers and frames mean extra labour and lead to endless trouble in the long-run. The hives principally in use in the Dominion are the ten- and twelve-frame Langstroth, and experience of his district will enable the beekeeper to decide as to the best one to adopt. Careful inquiries should be made from beekeepers of long standing in the district as to the best style to use.

Cheap Frame Hive.

Though there may not be much gained in the long-run by making any other than good substantial hives in the first place (especially by those who can construct their own), there may be those to whom the question of saving a shilling or two upon each hive is a consideration. In such cases the following directions for converting a benzine-case into a frame hive of the same dimensions as the standard Langstroth and which complies with the Apiaries Act should be of service :—

Procure a complete and sound case and carefully take it to pieces, then rabbet the ends of one edge to a depth of $\frac{7}{8}$ in. by $\frac{1}{2}$ in. to carry the frames. A tin rabbet should be nailed on the inside, to stand $\frac{1}{4}$ in. above, on which the

frames will rest. Now cut the sides so that they measure 20 in. Nail together, and this will give a hive the inside dimensions of which are 18¼ in. by 14¼ in. by 9⅝ in. A loose bottom-board may be constructed 24 in. by 15 in. wide. Nail on the board three strips of wood, ⅜ in. by 1 in., running along two sides and one end, so that when the hive is rested on the bottom-board it will leave an entrance ⅜ in. deep. Top of surplus boxes can be made in the same way. The best roof to use is a flat one. It may be made from the surplus timber of the benzine-case, and should telescope to a depth of 3 in. over the hive. Cover the top with ruberoid, zinc, or other waterproof material, and let it overlap the edges.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

Mushroom-growers who had difficulty in keeping the shed temperature down in summer now find cropping curtailed by the low night temperatures experienced at this season, even with widely spaced beds and a heavy covering of straw. It is obvious the rough shed built of second-hand materials has a very limited use for growing this crop. To maintain a temperature of 50° to 60° F. at night during the winter period a fairly substantial building is required, unless the beds are made much deeper and well covered up, which is not to be recommended where the supply of compost is limited. For commercial cropping at all seasons an insulated building which can be thoroughly fumigated and sterilized is necessary. This is probably best provided by an asbestos-sheet lining with tightly packed shavings between it and the outer wall, which may be of asbestos or corrugated iron. The roof, outside, may be of iron, or timber covered with a thick burlap tarred and sanded. Well-fitted ventilators should be built into the base of the walls and in the roof, and the floor laid in concrete and drained. In the warmer localities very little artificial heating will be required in such a house, especially if it is built in a dry, well-drained position. The beds may be tiered at intervals of 2 ft. with at least 3 ft. between the top bed and the roof, and no straw covering need be used.

For cleaning, and to facilitate the working of the house, the bed boards of 8 in. by 1 in. rough timber should be laid loose; also the 6 in. by 1 in. side boards for the beds. Where extensive cropping is done the bottom bed should not be placed on the ground, but on boards 8 in. to 12 in. above it. Catch crops may be grown in all sorts of places, but only so long as the conditions may be controlled for the necessary period. There are, however, usually definite limitations to the period when conditions can be controlled except in a building which is specially equipped; such a place should therefore be provided where mushrooms are regarded as an important crop.

Growing of Asparagus.

The life-period of perennial herbaceousplants varies widely; that of edible asparagus, *Asparagus officinalis*, is one of the longest—three or four years is the really productive life of most plants of this class, but good crops have been gathered from asparagus plantations four or five times as old as that. Apart from a good seed strain, production depends on good natural conditions and regular attention. This species is a native of Europe and Central Asia, where it is usually found growing by the sea-coast and river-banks. The light, deep, moist, well-drained soil found about estuarian flats in a temperate climate is its natural home, and such country should be selected for commercial production. The month of August, when the young plants are about to commence the new season's growth, is very suitable for setting out new

plantations. For this purpose graded one- or two-year-old plants are best. There must be no doubt as to the eradication of twitch and persistent weeds of every kind, the ground must be thoroughly clean, and if not naturally rich it should receive generous dressings of organic matter, which should be turned in deep. This plant is very partial to supplies of potash and nitrogen; a generous potash dressing should therefore be included in the preparation of the land for planting. If a dressing of kainit has not already been applied, 3 cwt. per acre of sulphate or muriate of potash should be applied now.

In older countries extensive experiments have been carried out to ascertain the most profitable planting distances, and local experiences endorse most of their conclusions on this point: 18 in. between plants and 5 ft. or 6 ft. between rows—the wider space in the richer soil—is usually the optimum spacing for commercial crops. In the homestead garden a double row may be planted, 18 in. between plants, and the two rows making the double. If more is required, there should be an interval of 5 ft. before planting a further double row. Asparagus plants are set deep. The usual method is to plough out a furrow 10 in. deep, place the plants in position, and cover firmly with about 2 in. of soil, the remainder of the filling being made during the summer during subsequent cultivation while the plants are growing. The ultimate covering is about 8 in., or rather less if the land is inclined to be heavy. No cutting is done the first season after planting, but at the second spring growth a short cutting season of two weeks is done if good progress has been made.

Where asparagus plants are required for planting next year seeds of a good strain should be sown now so that a long season of growth will be obtained to enable sturdy plants to be produced. As with other seed-beds, it is important that weed-seeds near the surface should be germinated and destroyed before sowing, thus obtaining a clean seed-bed. To hasten germination asparagus-seed is soaked in hot water, about 85° to 90° F., for a period up to four or five days, the surface moisture is then dried off, and the seed sown at once. The sowing is made sufficiently thin to produce good plants at intervals of about 3 in. or 4 in —a depth of 2 in. to 3 in. and 24 in. to 30 in. between rows is usually most suitable.

Treatment of Soil.

The asparagus crop is partial to an alkaline soil condition, and established plantations unless given generous treatment during the summer immediately after the cutting season has finished, should now be given 6 cwt. basic super phosphate and 2 cwt. sulphate or muriate of potash per acre, and such prepared farm manure as may be necessary to maintain the supply of humus in the soil. In any case, early in the month of September a dressing of nitrate of soda 2 cwt. per acre should be applied and repeated at monthly intervals as may be necessary. The present dressing is broadcasted and disked in both ways and the land harrowed down—further cultivation being done between the rows as may be required.

Sooner or later during the month of August all of the early crops, including turnips, potatoes, globe beet, carrots, and peas, may be sown; main crop parsnips, onions, artichokes, cabbage, cauliflower, lettuce, and parsley may also be sown. Towards the end of the month kumaras are bedded down on a hot-bed, and celery, melons, cucumbers, and half-hardy crops of most kinds are sown with a view to producing sturdy plants for setting outside in about two months' time, when hard frosts have about finished for the season.

In the larger establishments and in the colder districts the hot-bed often takes the form of a low, gable-roofed glasshouse, 12 ft. to 14 ft. wide, heated by means of hot water carried round the interior in 4 in. pipes, or by means of an electric cable bedded in sand on the bench. In smaller gardens the hot-bed is a stack of fermenting stable manure 2 ft. or 3 ft. high and sufficiently wide to have a margin of about a foot when a glass frame is placed on top. In warm districts less manure is necessary to maintain the desired temperature, which is about 55° to 60° at night. The preparation of the

stable manure will take about two or three weeks to bring it to the desired state of fermentation. More care is generally necessary in carrying out this operation. It is important that the material should be moist, and light sprinkling should be done when turning it, as is necessary, to maintain this condition; at the same time, it should not be exposed to heavy rain during treatment. Where stable manure is scarce lawn mowings and fallen leaves may be mixed in to assist in making up the desired quantity. The desired temperatures are more readily obtained in the hot-bed if it is made in a well-drained, sunny, sheltered spot, also when the frame is well built to exclude cold draughts and in cold wet weather it is well covered up at night. The precaution which is most important is to air the plants by adjusting the sash-lights, especially in the early morning on fine days. There is no doubt the most fertile cause of disease amongst these crops is just the neglect of this attention. Much water will not be required at this stage, but what is given should be tepid.

Parsnips and other mature roots in the ground towards the end of August should be lifted before a second growth commences and stored in a cool place.

Small and Sundry Fruits.

The emphasis laid on the subject of ventilation of the tomato crop under glass during the period of October onwards has no application at the present time when the young plants have just been, or are about to be, planted out. There is no comparison between the two sets of conditions. The emphasis on generous ventilation is confined strictly to the summer period. The subject of ventilation requires much consideration and attention during the changeable weather of springtime in the unheated glasshouse to bring the plants along steadily without a check from a cold snap or being forced in high temperatures during a warm interval. Attention at this period is probably the most important factor in securing a good crop, and it must be given promptly so soon as any serious change in weather temperatures takes place.

For planting outside towards the end of October, and later, the tomato plants left over at the present time are unsuitable, as they will become stale and somewhat stunted. Sowings should be made at intervals from August onward to provide fresh plants for the outside crops, as steady growth without a check is indispensable for the best results. In this connection seed-strain, it should be remembered, is of the greatest importance. Vigour and health, as well as type, lie to a great extent in the strain of seed which is sown. For commercial cropping every care must be taken to obtain the most suitable.

Chemical Spraying.

To obtain good crops of small fruit much can be done by sound, clean management, such as planting out healthy stock in fresh ground, also cutting out and burning old canes of raspberry, loganberry, &c., so soon as the crop is gathered. A certain amount of chemical spraying is also necessary, and that applied during early spring is probably of the greatest importance. For leaf-spot fungus (*Mycosphaerella fragariae*) attacking strawberry plants a 1-per-cent. Bordeaux spray—Bordeaux 4-4-40—should be applied during the month of August and repeated as necessary, which will be for some time in the more humid districts. During the summer period lime-sulphur solution, with a polysulphide content of 1 per cent., may be used—that is, one part of standard lime-sulphur concentrate to 150 parts water.

For cane-wilt fungus disease (*Leptosphaeria coniothyrium*), which is fairly common among raspberries, as well as other troubles of the kind, Bordeaux 5-4-50 is applied at bud movement and twice subsequently at about monthly intervals with Bordeaux 3-4-50.

Both gooseberry and currant bushes are affected with leaf-spot fungus disease (*Mycosphaerella grossulariae*). Where this occurs a spring application of Bordeaux 5-4-50 is desirable, which may be followed with advantage by an autumn application at the same dilution.

Probably the most serious disease of the passion-vine is the brown-spot found on leaves and fruit, also on leading growth, which may eventually be cinctured and cause long sections to die. This brown-spot, or die-back, disease is caused by a fungus which has been identified as *Gloeosporium fructiginum*. The best control is obtained by pruning the vines with secateurs so soon as hard frosts are over for the spring, and spraying with Bordeaux 6-5-50 just before blossoming, and repeating it at intervals as required at a strength of 3-5-50. The trouble is most acute during a wet growing season.

The Homestead Garden.

During recent years heavy losses of crop have been experienced because they have been exposed at critical periods to high winds accompanied by heavy rain. Live-stock in cold, open country has also suffered severely in winter, while in summer the absence of any shade is a discomfort to them, which is almost as serious. These losses can only be avoided by planting shelter-trees, which to be effective must be carefully selected and planted after giving full consideration to the past experience of the kind in the locality. Fencing-posts and firewood are also important considerations in the back country, and it is most convenient to grow them on the spot where they are required, instead of hauling them long distances. The months of August and September complete the planting season for trees of this kind, and to avoid the loss of another growing season work of that class should be carried out without delay in fine weather.

Such fruit and ornamental trees and shrubs as may be required about the homestead should also be planted now. Past experience has probably indicated the classes most suitable to the locality, and it is often best, in the main, to confine the selection to further species and varieties of those classes that have proved most suitable, thus providing a pleasing diversity which will flourish with a minimum of attention.

Seeds of hardy annuals may now be sown outside and half-hardy annuals in frames for planting out when spring frosts are over.

—W. C. Hyde, Horticulturist, Wellington.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

"THISTLE MOUTH" IN LAMBS.

A. W. M., Norsewood :—

What is suitable treatment or cure for the so-called disease "thistle mouth" commonly found on lambs at this time of the year? If not treated would the disease disappear eventually?

The Live-stock Division :—

The use of the term "thistle mouth" in the case of lambs apparently is a description of an ulcerative condition affecting the lips and nose of lambs resulting in the formation of thick crusts on these areas. The treatment consists of the removal of the affected lambs and their segregation on a pasture of fresh young feed, if this is available. The application of a weak antiseptic lotion such as a 1-per-cent. solution of lysol in water will assist in allaying the irritation to enable healing to take place. In cases where there is much "proud flesh" an astringent lotion of copper sulphate in water, using about 1½ oz. of bluestone per gallon of water, assists in the removal of the thick crusts and facilitates healing. Mild cases frequently recover when suitable pasture can be obtained and the irritating factor removed. It is, however, advisable to carry out some treatment as suggested. The selected lotion may be repeated after a few days, when healing quickly occurs.

TREATING FOOT-ROT IN SHEEP.

R. J. D., Canvastown :—

What is the best treatment for the cure of foot-rot in sheep ? A few sheep affected have been treated by paring the hooves and then treating the affected parts first with spirits of salts and finally with an ointment composed of equal quantities of stockholm tar and powdered bluestone.

The Live-stock Division :—

The treatment of foot-rot in sheep by means of trimming the hooves of affected animals and then applying a foot-rot ointment as outlined should prove satisfactory. The application of spirits of salts can be recommended only in certain cases, and it appears in your case that the use of spirits of salts followed by an application of the strong bluestone tar ointment may prove too caustic in its action. It is therefore recommended that a weaker tar ointment be applied after the hooves have been trimmed, and that you discontinue the use of the spirits of salts in the meantime. It is advisable to use an ointment composed of 1 part of bluestone to 3 parts of tar. The best drained paddocks should be selected for the affected animals until recovery takes place.

CARE NEEDED IN FEEDING LUPIN-SEED.

T. W. H., Hororata :—

Could blue-lupin seed be used for feeding to pigs ? Would crushing lessen their toxic effect ? Could the seed be used as a winter ration for in-lamb ewes together with hay or straw ?

The Live-stock Division :—

Blue-lupin seed is generally accepted as being less toxic than seed from the yellow variety. At the same time, it is necessary to recognize that a chronic disease known as lupinosis is known to follow the ingestion of any variety of lupin, whether plant or seed, the yellow lupin being considered to be the most toxic. Heavy mortalities among horses, cattle, sheep, and pigs have been attributed to the use of lupins. On account of the greater susceptibility of pigs to any foodstuff containing toxic matter, one cannot recommend the use of blue-lupin seed for this class of animal. The seeds are more harmful than the plant. Crushing will not lessen the toxic effect of lupin-seeds. The seeds can be fed to animals if they are well soaked and washed in water and the toxic principles leached out. A strictly limited amount of not more than $\frac{1}{4}$ lb. per head per day of unleached ground-up seeds may be fed to sheep when mixed with cut fodder. Up to 1 lb. per head per day may be given when the seeds are thoroughly leached. On account of the toxic alkaloids, one cannot recommend the use of the seeds for in-lamb ewes ; in fact, it is advisable to limit any use that may be made of the seed to non-breeding stock.

SOYA BEANS.

J. B. R., Remuera :—

Can you tell me if there is any variety of soya bean that is suitable for growing as a vegetable in a small garden ?

Also what is the edible portion ?

Does one boil the green pods after the style of French beans, or does one thresh the ripe beans out of the pods and cook them like haricot beans ?

What is soya-bean flour ? Can one make it from the ripe beans by grinding, say, in a coffee-mill ?

Horticulture Division :—

The soya bean is not usually sold at present among the seeds for the small garden. The Sanitarium Health Food Co., have a variety which it is stated has been grown satisfactorily in the warmer parts of the country. The beans are cooked as haricots ; they require to be soaked overnight and boiled for three hours, changing the water twice meanwhile. Better still, they may be boiled in a pressure cooker in about half an hour.

Soya-bean flour is one of the many products of these seeds. At present supplies are imported, and it is doubtful if simply drying and grinding the seeds would give a satisfactory product.

WEATHER RECORDS: JUNE, 1937.

Dominion Meteorological Office.

NOTES FOR JUNE.

General.—June was a very cold month, and, in spite of the fact that over much of the country the rainfall was below normal, it was also a damp one in most districts. Except in places especially exposed to the southerlies or south-easterlies which prevailed throughout most of the month, winds were not strong. There was, consequently, little drying, and the soil is almost everywhere saturated with moisture. Work on the land has been difficult, and a smaller area than usual has been sown in wheat. After the first few days growth of pasture practically ceased, and the older material has deteriorated. Hand feeding has been resorted to to a considerable extent, but so far there is no shortage of feed. Stock are, on the whole, doing well, with the exception of hoggets, for which it has been a poor season. The milk-yield has fallen away rapidly. Vegetation in general does not appear to have suffered, and in many places flowering plants have done rather well.

Rainfall. — Rainfall was much above normal in the Auckland and Coromandel Peninsulas. Parts of North Auckland had double the average, and some severe flooding occurred there towards the end of the month. There were large deficits in most of Marlborough, Nelson, Westland, the interior of South Canterbury and Otago, and in the interior of the North Island. On the west coast and in the southern interior of the South Island it was a particularly fine month, with few wet days.

Temperatures.—Temperatures were everywhere below normal.

Sunshine.—Sunshine was much above normal on the west coast of the South Island and somewhat above, also, in Nelson and Blenheim and the southern portion of the South Island. At Waipoua, on the western side of the Auckland Peninsula, more than average was recorded.

Pressure Systems.—At the beginning of the month a cyclonic depression was located over the western Tasman Sea, while pressure was low to the east of New Zealand. This depression moved in a south-easterly direction till it reached southern New Zealand on the 4th as a deep westerly depression. Strong northerlies preceded it, there being gales in Cook Strait on the 4th. There was general rain with many heavy falls. On the 5th came a change to cold, strong southerlies, with widespread snowfalls. Hail and thunder also occurred in many places. On the 4th a small tornado did some local damage at Uruti, in Taranaki.

From this time onwards southerly or south-easterly winds and cold weather were persistent.

From the 7th to the 10th shallow depressions were passing to the north of New Zealand, and on the 12th a westerly depression affected the southern portion of the South Island.

From the 16th to the 18th a cyclonic depression crossed the central part of the Dominion, bringing much rain to the North Island, with some strong north-east to easterly winds in the Auckland Province.

On the 20th a cyclone developed off the coast of New South Wales. This became very deep and extensive and moved eastward very slowly. It crossed New Zealand on the night of the 24th. Very rough weather was associated with its passage across the Tasman. In New Zealand it caused strong easterly winds as it approached, and was followed by strong south-easterlies. These brought very cold weather and further extensive snowfalls. Several secondaries followed the main cyclone, moving from the north-west past the North Island. There was much rain in North Auckland and between Hawke's Bay and East Cape, with flooding in places, especially about Whangarei. The South Island, except for snow on the 24th, was comparatively little affected.

RAINFALLS FOR JUNE, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Fall.	Total Rainfall to Date.	Average Rainfall to Date.
	North Island.					
	In.		In.	In.	In.	In.
Kaitaia	7·14	13	2·35	6·59	35·90	28·16
Russell	20·43	15	6·15	6·67	63·72	30·63
Whangarei	18·40	21	6·27	6·54	51·76	31·60
Auckland	7·25	22	1·59	5·44	25·99	24·28
Hamilton	..	..	..	5·11	..	23·90
Rotorua	2·65	15	0·67	5·25	28·44	26·87
Kawhia	..	..	..	5·72	..	25·54
New Plymouth ..	5·92	16	1·22	5·95	32·08	28·54
Riversdale, Inglewood ..	5·98	14	1·32	10·27	51·59	48·65
Whangamomona ..	..	..	..	7·89	..	35·70
Hawera	3·17	13	1·00	4·41	22·74	21·39
Tairua	10·49	16	2·25	6·97	30·71	33·56
Tauranga	4·83	18	1·06	5·35	30·11	26·88
Maraehako Station, Opotiki	2·91	9	1·76	5·66	31·64	27·79
Gisborne	5·21	15	1·70	4·90	19·08	24·91
Taupo	2·11	14	0·44	4·56	18·31	21·36
Napier	2·98	14	1·06	2·92	11·57	16·08
Hastings	3·67	14	1·15	3·07	9·41	16·63
Taihape	2·84	20	0·52	3·38	17·66	17·81
Masterton	3·74	20	0·78	3·59	16·78	18·77
Patea	3·41	15	1·03	4·24	24·33	21·40
Wanganui	1·73	9	0·62	3·37	19·09	17·70
Foxton	0·99	10	0·33	3·39	13·12	15·27
Wellington	3·33	21	0·78	4·31	18·66	20·89
	South Island.					
Westport	..	..	..	8·85	..	46·50
Greymouth	3·96	12	1·22	8·80	56·10	49·56
Hokitika	3·97	11	1·18	9·22	59·62	55·09
Ross	5·03	7	1·60	8·73	71·64	62·77
Arthur's Pass ..	..	..	..	10·53	..	75·94
Okuru, South Westland	1·60	2	1·00	10·72	78·62	72·04
Collingwood	3·51	12	1·39	10·30	47·47	45·08
Nelson	1·25	6	0·75	3·51	18·61	18·32
Spring Creek, Blenheim	1·38	9	0·36	2·94	14·77	14·47
Seddon	1·84	10	0·59	2·09	13·30	12·32
Hanmer Springs ..	5·09	17	1·23	3·39	17·75	21·77
Highfield	4·10	13	0·95	2·47	12·29	16·74
Gore Bay	5·78	10	1·76	2·69	18·92	15·87
Christchurch	2·12	19	0·50	2·53	12·80	12·63
Timaru	0·96	7	0·39	1·75	13·23	11·14
Lambrook Station, Fairlie	0·80	6	0·25	1·86	11·61	11·98
Benmore Station, Clearburn	0·93	8	0·33	1·81	16·27	12·80
Oamaru	0·74	10	0·27	1·98	9·93	10·98
Queenstown	1·10	8	0·54	2·22	17·28	15·35
Clyde	0·13	3	0·07	0·92	10·13	7·76
Dunedin	3·25	15	0·88	3·14	26·57	18·08
Wendon	2·06	12	0·79	2·59	27·70	15·48
Balclutha	2·24	18	0·37	1·99	21·72	12·71
Invercargill	2·90	20	0·75	3·64	24·83	23·31
Puysegur Point ..	6·02	20	1·52	6·59	48·30	42·26
Half-moon Bay ..	..	..	..	4·91	..	29·13